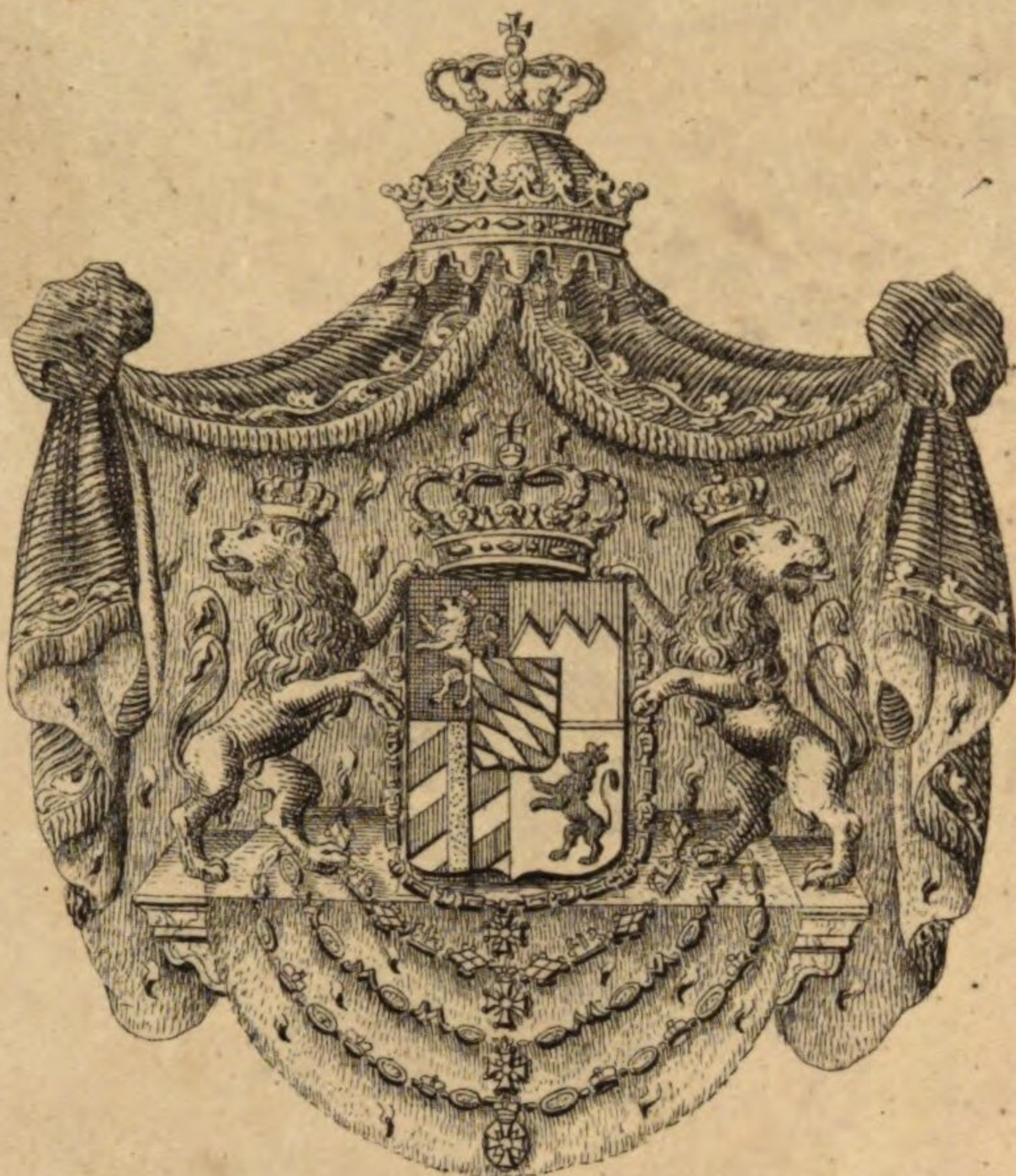


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REGIA
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Ex donat Molliana.

Yr Remembrance
with the best Respects
from the Author

4

[Faint, illegible handwriting in blue ink, possibly a signature or address, located at the top of the page.]

A
S Y S T E M
OF
M I N E R A L O G Y.

SYSTEM

OF

MINERALOGY.

A
SYSTEM
OF
MINERALOGY,
FORMED CHIEFLY
ON THE
Plan of Cronstedt.

VOL. I.

By J. G. SCHMEISSER,
F. R. S. &c.

LONDON:

PRINTED FOR C. DILLY IN THE POULTRY.

1794.

SYSTEM

MINERALOGY

FORMED CHIEFLY

OF THE

Mineralogy of Germany

VOL. I

BY J. G. SCHUMMEISSER

F. R. G. 38

LONDON

PRINTED FOR C. BULLY IN THE ROYAL

1794

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TO THE RIGHT HONOURABLE

CHARLES GREVILLE,

AND

Sir JOSEPH BANKS, *Bart.*

PRESIDENT OF THE ROYAL SOCIETY, &c. &c.

GENTLEMEN,

I LAY the present Work before you with no less propriety than pleasure, knowing how eminent one of you stands as the encourager and judge of the Science of Mineralogy in particular, and how eminent the other as the patron and judge of Universal Science; to both of you, I beg leave to acknowledge
publickly,

(vi)

publickly, my many obligations, as
well as the honour, with which

I am,

GENTLEMEN,

Your obedient,

And devoted humble Servant,

J. G. SCHMEISSER.

PREFACE.

I FEEL a particular pleasure in thus laying before a candid, liberal, and discerning Public, the fruits of my labour and study, intended to improve the science of Mineralogy ; a science, which, though it has been attended to by philosophers, has not, however, advanced towards perfection, with that rapidity which has characterized the progress

gress of other sciences, that have been cultivated with a degree of enthusiasm, and with a satisfaction such as I experienced in bringing this work to a conclusion; a work, not undertaken to answer interested purposes,—to procure emolument or fame, but to furnish the English student with a correct, improved, and easily intelligible system of Mineralogy.

I hope, however, I shall not be considered as arrogating to myself more merit from this publication, than I can justly claim. I acknowledge, with pleasure, the obligations I am under to many eminent Mineralogists—to Wallerius, Cronstedt, Bergman, and Lametherie, for the Chemical part;—to Bruckman, for the description of the gems;—to Romé de Lisle, for the
Figures;

Figures;—and to Werner, and Karsten, for the description of the external Characters.

I flatter myself, however, that those who are skilled in this science, will find that I have done more than borrow from the Authors I have mentioned; that I have selected what was most essential in their works, and rejected what was bad or indifferent; that I have compared their various opinions with my own; corrected errors, and supplied that part of Chemistry, without which, Mineralogy can never be successfully studied.

The Reader will therefore perceive, that the present publication is not merely designed for those, who are satisfied with an account of the external appearances

ances of minerals, but that it is particularly intended to explain the nature and utility of the substances it treats of; the better to form a rational, useful, and entertaining work, which it will be my particular endeavour to improve at a future period, when I hope to be able to lay before the Public, a new arrangement of Minerals, founded on such principles as my own observations and experiments may enable me to establish, with a view to approach nearer and nearer to the knowledge of the means which nature has employed in the formation of Minerals, and to discover the purposes for which she designed them.

I am now to observe, with regard to the arrangement of the different parts of this work, that I have divided Minerals

nerals in general, into Classes, Genera, Species, and Varieties; though I am very sensible, that they do not exhibit such distinguishing and constant marks as organized bodies.

I have introduced at the beginning of the work, Werner's external characters, and added such chemical rules and observations, as will, I hope, enable gentlemen, not deeply read in chemistry, to examine or analyze substances with which they are unacquainted.

I have taken the Synonyma of substances belonging to the different Species and Varieties, from eminent Authors; from Wallerius, Cronstedt, Born, Werner. The other Synonyma may be found

found in the last edition of the *Systema Naturæ*.

I have also given the names of substances in various languages, and introduced the new chemical terms, where they could be introduced with propriety, as they indicate the substances of which compounds are formed, much better than the old names. I have beside pointed out the general marks and properties which substances exhibit belonging to certain classes, genera, and Species. I have given the derivations, and mentioned the inventors, of such names as I could ascertain. I have pointed out the different appearances of substances, when in a crude and manufactured state, and the discriminative characteristics of minerals; their
physical

physical and chemical properties; the places and situations in which they are generally found; and the uses to which particular substances are, or may be, applied. Nor have I neglected to mention the curious qualities and properties of bodies, or to explain the origin of the different states in which Minerals are found.

At the close of the work, an account is given of different rocks, whose component parts are pointed out.

I wished also to give the names of the different Authors who have written on each substance; but as they are so numerous, I shall decline doing so at present; but, at a future period, as soon as leisure will admit, I shall mention them
in

in a Supplement which I propose to Publish, which will contain an arrangement of Minerals, according to a plan of my own, and an account of such substances as I may have omitted in the course of this Work. It will also point out the manner of working or analyzing Minerals, a knowledge not to be expected from manufacturers, who rarely possess sufficient chemical knowledge to enable them to extract from the substances they make use of, whatever they are capable of yielding.

I have now only to express a hope, that this Work, of which the Second and concluding Volume will soon meet the Public Eye, may be reviewed by those who are thoroughly acquainted with the subject matter of it, who, if
they

they detect errors, will point out how they may be corrected, how the Work may be improved, and rendered, in a future Edition, more worthy of Public approbation.

they being errors will point out how
they may be corrected, how the Work
may be improved, and rendered in a
future Edition more worthy of public
approbation.

I have a desire to give you some
hint of the manner in which I have
been employed in the revision of
this Work, and to let you know what
particular attention has been paid
to the various alterations and
improvements which have been
made.

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INTRO-

INTRODUCTION

MINERALOGY is generally understood to be that branch of natural knowledge which distinguishes and describes the various products of Nature which are found under & on the surface of the earth, and which differ from animals and vegetables, in being destitute of life, of a proper circulation of fluids, of propagation, and even of organic structure.

The progress of this science, though it has been cultivated for several centuries, has been very slow, and consequently its utility, which, especially in the present age, is becoming more and more generally felt.

Perhaps we have to regret the negligence with which some authors have overlooked the more essential part of this science, confining themselves to an investigation of the more natural appearances, and other imperfect marks of mineral substances, which they were unacquainted with that part of Natural Philosophy and Chemistry, so necessary in bringing forward the perfection of the study, and displaying its utility in the various arts.

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INTRODUCTION

(ii)

INTRODUCTION.

MINERALOGY is generally understood to be that branch of natural knowledge which distinguishes and describes the various products of Nature which are found under or on the surface of the earth; and which differ from animals and vegetables, in being destitute of life, of a proper circulation of fluids, of propagation, and even of organic structure.

The progress of this science, though it has been cultivated for several centuries, has been very slow, and consequently its utility, which regards so many purposes in common life, has been proportionally small.

Perhaps we have to regret the negligence with which some authors have overlooked the more essential part of this science, confining themselves to an investigation of the mere external appearance, and other imperfect marks of minerals, whilst they were unacquainted with that part of Natural Philosophy and Chemistry, so necessary in bringing forward the perfection of the study, and displaying its utility in the various arts.

B

It

It must be confessed, that Mineralogy would not have been even in its present state, if fortunately a Vogel, Wallerius, Bergman, Cronstedt, &c. who cultivated the study of Chemistry, had not clearly shewn, how much to this last science the history of minerals was to be indebted.

To those men we have to look up for many discoveries and improvements, which have put us in the way of rendering the science more useful and more perfect. If mineralogists before or after them, had adopted the same plan of chemical investigation, certainly many operations of nature in the mineral kingdom, still unknown to us, many ores which are still uninvestigated, and which only gratify the eye of curiosity in cabinets, would have been ascertained and described, together with the useful purposes, to which, in arts and manufactures, they might be turned.

Though much has been done, yet much remains to do; our knowledge is still confined as to the formation of minerals; and all that we can learn from Nature respecting her operation, is limited to some observations, which are derived from examining a variety of minerals, and from comparing various phenomena, which take place under the surface of the earth, with such results as occur in chemical processes, and arise mostly from those different powers and affinities, by which different bodies act upon each other, and to which we may suppose the different
states

states of minerals to be owing. In order to give the reader some idea of affinities, I have thought proper to lay before him an account of those which may have a place in the explanation of the formation of minerals.

Philosophers have ascertained that all homogeneous bodies have a tendency to attract each other, and to unite under certain circumstances; this property solid bodies exhibit when their surfaces are brought into perfect contact; as, for instance, two perfectly level and polished plates when in contact will attract each other, and will adhere by a certain power, which has been called the cohesive power; other instances we observe by the formation of large crystallization, arising from the attraction and cohesion of small particles. Fluid bodies also exhibit the same, as is seen in two globules of mercury attracting each other even at a small distance, and uniting.

Further, bodies of a different nature (heterogeneous) attract each other and unite, which philosophers have distinguished and given particular names to. Thus, when two heterogeneous substances simply unite into one, without suffering an alteration in their primitive properties, it is called affinity of mixture, or synthetical affinity. For example, when salts are dissolved in water, or when mercury unites with lead or another metal, this is called simple affinity—but when several bodies unite into one, it is called compound affinity of mixture.

Many heterogenous bodies will not unite, but by the intervention of a third; for instance, sulphur will not unite with water, but by the addition of pot-ash; zink will not unite with sulphur, but by that of iron.

In all these instances, the mixed bodies remain in union, and no apparent decomposition takes place. This is called appropriate affinity. Cases also occur in which one body shows no affinity to another, except it be first disposed to it by means of a third; here the added body unites with the one, and the other is set free; this is called preparative affinity: for example, sulphuric acid discovers no affinity to lead, except it be previously disposed by means of nitric acid; if lead is dissolved in nitric acid, and sulphuric acid be then added, the latter will unite with the lead, and separate the former. In this case the sulphuric acid shows even a stronger affinity to lead than the nitric acid, though the nitric acid has prepared the last for the combination, and was the preparative medium.

If two bodies of a different nature, one of them being a compound of two, be mixed, and a decomposition of the original compound takes place, so that a new body is produced, and one is set free; such phenomenon is called analytical affinity with simple synthesis. If, for instance, cinabar, which is a compound of mercury and sulphur,

phur, be mixed with iron, the iron will unite with the sulphur, and the mercury will become free.

But when the two mixed bodies are both of them original compounds of two, two new bodies are produced by the mixture. This is called analytical affinity with double synthesis. As for example, when kali vitriolatum and nitrate of lead be mixed together, a double decomposition takes place, and two new bodies, namely, vitriolated lead and common nitre, are formed.

Modern philosophers have also found that bodies possess very different degrees of affinity one to the other, and this property, as ascertained by chemists, seems to follow certain laws of Nature. Thus acids acquire a different proportion of alkali and earths for saturation. The quantity of a certain body necessary to saturate a menstruum or acid is in proportion to its affinity, such being called the dormant or quiescent, or latent affinity, and is expressed by the sum of weight. Thus, 100 grains of specific nitric acid require 215 grains of alkali for saturation; therefore the latter sum expresses the degree of affinity of those two bodies; but 100 grains of the same acid requiring only 40 grains of volatile alkali, the degree of affinity must be different.

The different dormant affinities betwixt acids and alkalies, or metals, are expressed in the annexed table.

The analytical affinity with simple synthesis is therefore explained, when, for instance, a simple body A. be mixed to another body composed of two, namely of B. and C. by which C. becomes free, arising from A. having a greater affinity to B. than C.; consequently those two bodies which have the strongest affinity to each other unite, and that which had the least becomes free.

The analytical affinity with double synthesis, where two new bodies are produced, is explained upon the same principles, or follows the same laws.

The following case will serve for an example; if, for instance, nitrate of silver, considered as a compound of A. (nitric acid) and B. (silver) one hundred grains of A. require 375 grains of B. for saturation, be mixed to muriate of pot-ash, considered as a compound of C. (marine acid) and of D. (pot-ash) one hundred grains of C. require 215 grains of D. for saturation, a decomposition and composition take place, and two new compounds are produced, consisting of A. and D. and B. and C. owing to different affinity to each other; because A. required only 375 grains of B. for saturation, and C. requires 420, therefore the analytical affinity of C. to B. exceeded the dormant of C. to D.

According to these phenomena, the following law has been proposed, that a decomposition of

mixture takes place, when the analytical affinity of two bodies exceeds that of the dormant, and *vice versa*.

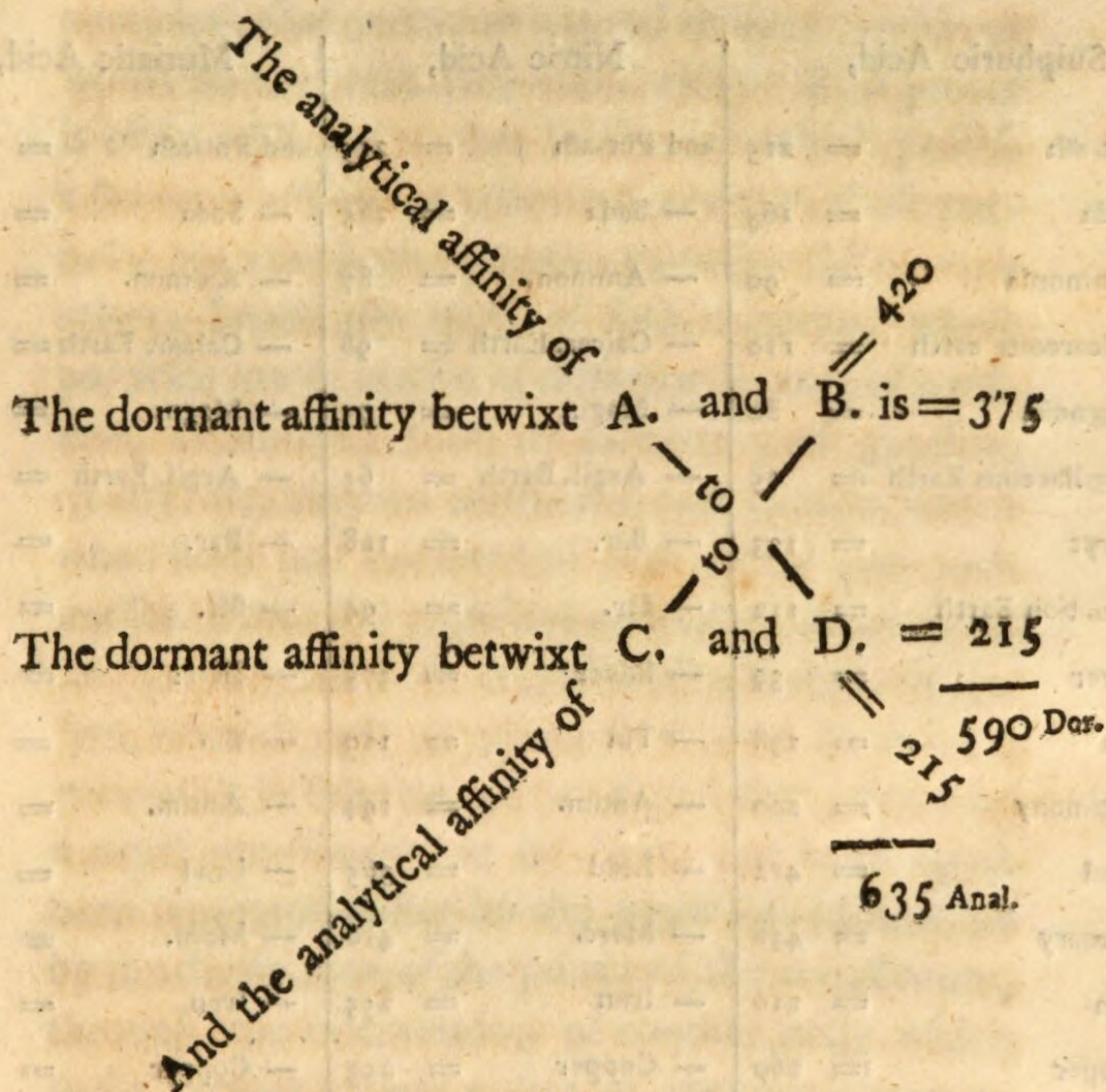


TABLE mentioning the quantities of alkalies, earths, and metallic substances, which 100 grains of the different acids are required to saturate; or the sum of the different substances gives the dormant affinities betwixt acids and those substances.

Sulphuric Acid,		Nitric Acid,		Muriatic Acid,	
and Pot-ash	= 215	and Pot-ash	= 215	and Pot-ash	= 215
— Soda	= 165	— Soda	= 165	— Soda	= 165
— Ammonia	= 90	— Ammon.	= 87	— Ammon.	= 79
— Calcareous earth	= 110	— Calcar. Earth	= 96	— Calcar. Earth	= 89
— Magnesia	= 80	— Magn.	= 75	— Magn.	= 71
— Argillaceous Earth	= 75	— Argil. Earth	= 65	— Argil. Earth	= 55
— Baryt	= 133	— Bar.	= 128	— Bar.	= 96
— Strontion Earth	= 112	— Str.	= 94	— Str.	= 56
— Silver	= 39	— Silver	= 375	— Silver	= 420
— Tin	= 138	— Tin	= 120	— Tin	= 130
— Antimony	= 200	— Antim.	= 194	— Antim.	= 98
— Lead	= 412	— Lead	= 365	— Lead	= 400
— Mercury	= 432	— Merc.	= 416	— Merc.	= 438
— Iron	= 210	— Iron	= 255	— Iron	= 265
— Copper	= 260	— Copper	= 255	— Copper	= 265
— Arsenic	= 260	— Arsen.	= 220	— Arsen.	= 290
— Zink	= 318	— Zink	= 304	— Zink	= 312
— Bismuth	= 250	— Bism.	= 290	— Bism.	= 250
— Nickel	= 320	— Nickel	= 300	— Nickel	= 310
— Cobalt	= 360	— Cobalt	= 350	— Cobalt	= 370

A know-

A knowledge of the afore-mentioned subject enables us to explain some of the operations which nature has employed in the formation of various minerals: by it we can also account, first, for the attraction and cohesion of homogeneous particles; that power or natural tendency, without which no concrete body could exist. This power is often assisted by other substances which possess a stronger affinity or adhering power to those particles than the homogeneous particles did to each other; hence the state of such minerals, whose particles are in masses of different degrees of hardness, occasioned from an admixture of gypsum, quartz, argillaceous earth, and calx of iron, which when fluid had involved or penetrated into such masses. From the attractive power we can account for (2.) the process of crystallization and precipitation, when simple or mixed substances have been previously in solution, or in a liquid state, either by a moist menstruum, or by heat, and have again been separated either by the mere loss of heat, or by the diminution of the power of the menstruum, through the intervention of another body which had a greater affinity either to the menstruum or to the dissolved bodies, as in cases of precipitation, or by the mere loss of the menstruum, as in evaporation. In the last case bodies will exhibit their perfect regular shape, 1. when the particles have been sufficiently separated from each other, by a proper quantity of the menstruum; 2. when they

they have been gradually deprived of it, so that the particles have had time to attract each other, by their proper angles and sides, by which they peculiarly adhere ; 3. when they have not been deprived of that quantity of moisture which some substances require to exhibit their perfect regular shape. But when they have been suddenly deprived of their menstruum, or when the natural attraction has been interrupted by violent motion, or by the accidental presence of another body, or by a gradual diminution of the substances contained in the solution, they then put on an irregular shape. Hence come the various modifications of the primitive figures discoverable in many minerals. Again, other substances, in consequence of their gelatinous nature, will not crystallize on losing their menstruum, but will coagulate, thereby not exhibiting their natural figure, but one as impressed by other bodies.

(3.) By the affinities is explained also decomposition, when simple or mixed bodies come into contact with another, which has a greater affinity to either of the component parts : This may take place either in the moist or dry way, according to the nature of the substances. Here one body either loses some of the component parts, or unites to another (as in the process of calcination, or in other cases where new compounds are produced). Thus, for instance, a mixture of sulphur and mercury (cinnabar) may
be

be decomposed by the admixture of iron, from the iron's having a greater affinity to the sulphur, when the mercury is set free, or when sulphur is united to silver or any other metal, and the sulphur comes in contact with oxygen, which has a greater affinity to the sulphur. Here a combination takes place, forming sulphuric acid, in which state it may then unite with another substance, and form another new body. In this manner decomposition and composition proceed. Again, the state of mineral bodies may originate from fusion, by means of heat, or subterraneous fire, and this last also may originate from the decomposition of other bodies containing that heat, or by the intervention of such substances as diminish the capacity for heat in some of the bodies, &c. Thus a mixture of sulphur and iron, when brought into contact with water, will decompose the water, and consequently diminish the capacity of that body for heat, which then becomes free, and more active according to the substances with which it comes into contact, and often to that degree as to burst forth in fire. Hence the variety in volcanic productions, which have undergone fusion in a greater or less degree, according to the nature of the substances.

The various colours which minerals exhibit, (1.) as to earths and stones, are to be ascribed to the quantity, state, and variety of metallic substances which unite with them during their formation.

formation. (2.) As to metals, they are to be ascribed to the different acids, or the different quantity of oxygen with which they unite. Thus copper exhibits different colours, as red, brown, black, yellow, green, blue; and lead, white, green, blue, red, and grey.

From the necessary union which chemistry ought to hold with the history of minerals, as thus shewn, it is deducible, that the principal object of mineralogy is not confined to a description of minerals by merely mentioning their different names, the places in which they are found, and the time and circumstances of their discovery; or by merely describing them according to their different external appearances; or by adding a few chemical properties, when the external marks do not lead to a proper criterion; or by giving what is called their component parts, especially when these perhaps were investigated during the imperfect state of chemistry; or lastly, by framing an arrangement suited only to the convenience of a cabinet.

But the essence of the science consists in a fundamental knowledge of the constituent parts of minerals, ascertained by patient inquiry, and so directed to useful purposes in the arts and manufactures, that instead of a barren nomenclature of ores, which only disgusts the student, we come to possess that sound system of the science,

science, which at once proves useful, important, rational and pleasing.

In an Introduction to a System of Mineralogy, however foreign it might be to treat with any detail the progress of the science, yet it seems necessary to mark the more material gradations which it has made, in order that by throwing some light upon former systems or arrangements of minerals, the reader may be enabled to judge of that which is the object of this work.

From the Ancients, who seem not to have particularly favoured this study, to modern times, we meet with some arrangements indeed which are scientific enough for the period in which they were written, others more fanciful than just, and a few altogether barren of much improvement upon the science.

We can only mention here the methods by which authors made their arrangements, as the arrangements themselves are to be learnt by consulting their different works.

THEOPHRASTUS and PLINY described minerals according to the various uses they were made of in common life.

AGRICOLA introduced some external marks, as colour, transparency, taste, smell, touch, including the temperature, humidity, density, hardness, gravity, and also figure.

The first figure he called indeterminate—the 2d tabular—the 3d globular, with angular figures,
as

as triangular, tetragon, pentagon, &c.—4th, such figures as resembled particular bodies, as capillary, lunar, horn - shaped, glandular, lenticular, ocular, stellated, &c. and he noticed also the appearances upon fracture.

Professor HAUSEN, among the moderns, considered particularly the lustre, structure, and the appearance of fragments.

WALLERIUS (1747) added more external characters; and after him CARTHEUSER (1755) and BOMARE (1764).

GEHLER considered particularly the smell, sound, taste, touch, colour, magnitude, specific gravity, hardness, tenacity, transparency, and figure.

LINNÆUS rather followed AGRICOLA's method, and dwelt particularly on the forms. Those minerals which did not exhibit any particular shape, he called amorphous, the others, 1. prismatic, pyramidical, lenticular, reniform; he considered—2. the surface—3. the texture—4. state of particles, as compact, friable, granular—5. fibres—6. structure—7. hardness, and—8. colour. As to crystals, he mentioned the number and figure of the sides of crystals, reducing all to two genera; one he called prismatic, the other cubical. He compared them, as well as the different shapes of minerals, with five salts, as natron, nitre, alum, common salt, and vitriol; such as he could not compare with
one.

one or other of these, he thought had obtained their shape from the space left by some unknown body.

CRONSTEDT appears to be the first who arranged the classes, genera, and species of minerals according to their composition and internal characteristics, and the varieties according to their external appearance: this arrangement has of late been improved by MANGELAN. Upon the constituent parts, proceeds with various degrees and improvements, the arrangement of BARON BORN (1772); of MONNET (1779); FOURCROY (1780); BERGMAN (1782); SAGE (1784); and afterwards LA METHERIE, who chiefly followed BERGMAN.

WALLERIUS, who, in the year 1788, again appeared with an improved system, in which he endeavoured to unite the external and internal characteristics; in order to arrange fossils more particularly according to the nature of the substances, he proposed in his classification the component parts, taking the external marks to assist: the order and genera to be classed according to composition, and the species according to external appearance.

Like WALLERIUS, Mr. GERHARD arranged minerals into classes and species, according to their chemical properties; taking the external
ap-

appearances, particularly structure and cohesion of particles, to assist when necessary.

PEITHNER and HILL reduced the external characters to certain divisions, and exhibited them upon tables. PEITHNER noted seven columns, including, 1. colour—2. transparency—3. figure—4. taste—5. smell—6. gravity—7. internal properties. He noticed also occasionally hardness, solidity, and sensation to the touch. HILL adopted six divisions or columns, including, 1. form—2. hardness,—3. gravity—4. surface—5. colour—6. peculiar properties. He also noticed occasionally transparency, smell, taste, &c.

1774. WERNER arranged species and varieties of minerals altogether, according to their external appearance.

1774. ROME' DE LISLE, gave the completest description and explanation of the different crystallizations of minerals; and after him ABBE' HUY communicated his useful explanation of the method of ascertaining the different crystallizations.

1784. DAUBENTON was for rejecting all species in his arrangement, as there existed, according to him, only varieties in minerals, which he divided into salts, sulphurs, stones, and

and such earths as are 1. unalterable in fire—
2. calcareous—3. vitrifiable, &c.

From this slight sketch of the means used by mineralogists for systematic arrangement, we are enabled to make some general reflections on the different characteristics which they have taken to build their systems or arrangements upon. These characteristics are external, physical, chemical, and empirical; and upon a question often disputed, which are the best, we have only to observe, that all of them, in the present state of mineralogy, are found necessary, and must be more or less adopted, according to the perfection of a system, and the fulness of description. They are not sufficient separately to furnish those marks, by which we can distinguish all the variety of mineral products from each other.

The external characteristics are not always sufficiently visible in many specimens of ores which occur to us; nor are they constant, as they vary according to the different operations, and accidental situations, to which minerals are exposed from various substances affecting them: nor, when ascertainable, are they always useful or satisfactory.

The physical and chemical properties certainly exist in all minerals, but they have not as yet been all sufficiently ascertained; as their investigation is often attended with expence, from the scarcity
C and

and smallness of some specimens; with incessant labour, from the great number of all; and lastly with uncertainty, from the difficulty of getting (by hitherto known experiments) at the state and proportions of their component parts.

Of systems of mineralogy which are formed upon these last, there is much uncertainty, and perhaps some error. Many instances have occurred, in which the same species of minerals, analysed by different chemists, has yielded a difference in the state and proportion of the component parts. Indeed it requires a long experience in the operative part of chemistry, to perform an analysis with accuracy, and even then we must be uncertain whether we have ascertained all the constituent parts of the analyzed mineral, till we can re-produce the original substance, both in appearance and property, (which seldom happens) by re-uniting the separated parts. I think we should confine the name component parts to those substances in which the analysis can be proved by synthesis, distinguishing all others by the terms, *substances obtained by analysis or chemical decomposition.*

Our knowledge is too imperfect as yet, to found a system, which shall at once do away all difficulties, and stand the severe test of application to all minerals. But it is presumed, that every new arrangement will proceed upon improvements, actually made by observations and experi-

experiments, by which no man of science, whose system has been in the least adopted or improved, can be offended.

Whatever system writers may frame or adopt, it is enough, that the arrangement be so made, that minerals which approach nearest to each other, with regard to their essential characteristics, follow in a proper order, and are clearly described as to matter and to language.

MINERALS

IN GENERAL

experiments, by which no man of sense, whose
system has been in the least adopted or improved,
can be offended.

Whatever system writers may frame or adopt,
it is enough, that the arrangement be so made,
that materials which appertain naturally to each
other, with regard to their essential characteristics,
follow in a proper order, and are clearly described
as to matter and to language.

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COMPARATIVE TABLES
OF
EXTERNAL
CHARACTERS OR APPEARANCES
EXHIBITED BY
MINERALS
IN GENERAL.

I.

WITH RESPECT TO COLOUR,

Principal Colours, and their different Shades.

SHADES.	
WHITE.	Milk White
	Greyish —
	Silver —
	Greenish —
	Blueish —
	Reddish —
	Tin —
C 3	
	GREY.

SHADES.

GREY.

{ Lead Grey
 { Blueish —
 { Soot —
 { Yellowish —
 { Blackish —
 { Iron —
 { Reddish —
 { Pearl —

BLACK.

{ Greyish Black
 { Brownish —
 { Blueish —

BLUE.

{ Indigo Blue
 { Prussian —
 { Royal Smalt —
 { Violet —
 { Sky —
 { Lavender —

BROWN.

{ Reddish Brown
 { Yellowish —
 { Blackish —
 { Chocolate —

GREEN.

{ Verdegreafe
 { Mountain Green
 { Grass —
 { Leek —
 { Pea —
 { Apple —
 { Yellowish —
 { Olive —

YELLOW.

SHADES.

YELLOW.

{ Brimstone Yellow
Straw —
Gold —
Lemon —
Clear Amber Colour
Orange —
Ochre —
Wax Colour
Candied Honey Colour
Bell Metal Colour

RED.

{ Aurora Red
Crimson —
Amethyst —
Scarlet —
Blood Colour
Copper Red
Carnation or Flesh Colour
Peach Flower Colour
Brownish Red
Rose Colour

TABLE II.
 SOLID FOSSILS,
 WITH REGARD TO FIGURE,
 THEY ARE FOUND,

(1.) OF COMMON SHAPE, *or of no particular form,*
That is, when their external appearance with
regard to form, cannot be compared to any
determinate figure of other known substances.

In this case we have to observe the state or
 condition, whether,

- | | |
|---|-------------|
| 1. In solid mass, spherical or
angular: or, | } the size, |
| 2. Interspersed with other substances. | |
| 3. In grains, either embodied or detached,
and the size. | |
| 4. Deposited upon other substances in the state
of plates or mere coating, the thickness
of those plates, &c. | |

(2.) OF PARTICULAR SHAPE. *That signifies when*
their form can be compared to that of another solid
body, frequently obvious in common life; in this
state they appear,

Either Dentated or tooth-shaped

Wire-shaped or filamentous

Capillary

Capillary

Ramified

Tubular

Reticulated

Stalactitical or dropstone like

Coralloid

Arborescent

Reniform or kidney shaped

Globular

Lenticular

Almond shape

Botryoid

Tuberculous

Cellular { 4-drangular, 6-angular,
polyaedral
spongy
double cellular.

OR WITH IMPRESSIONS.

*That is the mark or space left by other mineral
substances or plants, &c.*

As Cubical

Pyramidical

Cuneiform

Tabular

Perforated

Corroded

(3.) OF REGULAR FIGURE, or Shape of Minerals,
formed by Crystallization.

PRIMITIVE FIGURES.

1. TRIANGLE, Plate I. Fig. 1.
2. RECTANGLE, — — 2.
3. RHOMBOID, — — — 3.

(A.) Principal Figures, originating from the Pri-
mitive Figures.

DODECAGON — Fig. 4.

OCTAGON — — — 5.

CUBE — — — 6.

PYRAMID, simple or double, as to po-
sition, whether erect or inclined.—
Fig. 7. and 8.

PRISM, with or without Pyramids.—
Fig. 9. and 10.

TABLE OF PLATE, Fig. 11.

LENTIL, — — 12.

By these we have to ascertain,

1. The size or magnitude of crystals, or regular figures, according to the different dimensions.
2. The degree of the side or end angles, as-
certained by the Goniometer. Fig. 16.

(B.) A-

(a.) *Alteration of principal Figures, (B.) apparently produced by the Loss of Angles or Edges.*

(1.) By TRUNCATION, which signifies when the angles or edges appear as if cut short, so that a surface is exhibited on the place of the angle or edge.—Fig. 13.

(2.) By CUNIATION, which signifies that kind of alteration of primitive figure, when some or all its edges are doubly truncated, so that the oblique truncations terminate gradually in a sharp edge.—Fig. 14.

(3.) By ACUMINATION, which signifies when the ends of a regular figure terminate in an acute or obtuse angular point.—Fig. 15.

By all these alterations we have to observe the part or place from which those alterations proceed, the magnitude or dimensions, and the form of faces.

Coherency of regular shaped Crystals.

By this we have to observe the part or place by which they adhere, either by the sides, basis, or edges.

Appearance of the Surface of Fossils.

APPEARANCES.

As to Lustre.—Whether, Metallic,
Vitreous,
Pearl,

or,

or, Resinous Lustre,

Glittering, or Dull.

Indicating the degree of intensity,
which distinguishes any particular
Lustre.

OTHER APPEARANCES OF SURFACES.

Whether Smooth {
Rough { degree

Uneven

Granulated

Streaked in what direction, and on
what sides

Reticulated, &c.

*Appearances of Minerals, when fractured, or
when broken.*

FIRST,

As to Lustre.—*Vide the different Lustres, Page*
27.

SECOND,

As to the Nature of the Fractures.

Whether Even

Uneven

Earthy

Conchoidal

or, Shivery.

State

State and Condition of the Particles of a fractured Surface.

AS TO TEXTURE.

1. Whether Compact or Fibrous, and according to the dimensions and thickness of the fibres.
2. Whether Lamellated or Scaly, and of what dimensions and thickness.

AS TO THE DIRECTION.

Whether Straight or parallel

Curved

Undulated

Diverging, radiated

Stellated

Fascicular

Confused.

AS TO THE FORM OF FRAGMENTS.

Whether Cubical

Rhomboidal

Shivery

Orbicular

Cuneiform

Pyramidical

Angular { acute
 { obtuse

Columnar, as to the magnitude and number of sides.

Granular { size

As

As to TRANSPARENCY. Minerals may be Transparent, Semi-Transparent, nearly Opaque, or Opaque.

1. **TRANSPARENT**, when objects can be clearly distinguished through them, when in masses or thick plates, or only when in thin plates.
2. **SEMI-TRANSPARENT**, when objects can be perceived, but not distinctly, through masses, or only when in thin plates.
3. **NEARLY OPAQUE**, when bodies possess a slight degree of semi-transparency, when held to the light.
4. **OPAQUE**, when bodies completely exclude the rays of light.

TRACES OR MARKS produced on rubbing Minerals upon the Touchstone, upon Paper, or between the Fingers.

APPEARANCE of Particles with regard to Colour, occasioned by scraping the Surfaces of Minerals.

HARDNESS.

According to the different Degrees.

1. Such substances, whose surfaces cannot be scratched by another Mineral, as the Diamond.
2. Scratched

- | | | |
|---|---|--------------------------------|
| 2. Scratched only by diamond, | { | strike fire
with
steel. |
| 3. ————— rock crystal, | | |
| 4. ————— a hard knife, | | |
| 5. Scraped by a knife, | { | strike not fire
with steel. |
| 6. Scratching tin, or lead, | | |
| 7. Suffering impressions
by the nails, — | | |

SOLIDITY, whether malleable or brittle, and in what degree.

FLEXIBILITY. {
ELASTICITY. { and the degree.

FRAGILITY. { Whether difficultly or easily
broken, or split asunder by the
pressure of the hammer, whe-
ther difficultly or easily to be
reduced to a fine powder.

Adhesion to the tongue { degree.

SOUND.

1. Sonorous in different degrees.
2. Creaking on friction or pressure.
3. Crackling, &c.

SENSATION ON THE TOUCH.

Greasy }
Soapy } degree.
Rough }
Cold }

GRAVITY.

GRAVITY. *According to the Quantity of Weight which they lose in distilled Water; which is ascertained by weighing a solid Substance, first in common Air, and afterwards suspending it in distilled Water, (of a certain Temperature) by means of a hydrostatic Balance, and ascertaining how much the Body has lost of its first Weight, that is, the Sum of Weight which was necessary to bring the Scale in Equilibrium after the Substance was suspended in Water. The Sum of its absolute Weight is then to be divided by the Sum of Weight which the Body has lost in Water, and the Quotient will show the specific Gravity.—N. B. It is to be observed, that the Mineral must always be weighed in a Liquid which does not act upon it; for this Purpose either distilled Water, or Spirits of Wine, or Oil of Turpentine, must be used accordingly.*

SMELL.	{	without friction,	{	Urinous
		or when rubbed,		Sulphureous
		or by breathing		Bituminous
		on them.		Arsenical, &c.

TASTE.	{	Sweetish
		Acid
		Bitter
		Saline, &c.

CLASS

CLASS II.

Physical and Chemical Properties.

Attracting iron

Attracted by the magnet

Electric, { when rubbed, { degree.
 { ——— heated, {

Phosphorescent, { when exposed to the sun, or
 { when thrown upon red-hot
 charcoal or iron.

Absorbing moisture { become liquid
 { remain dry.

Decomposed by air

Alteration { degree { fixed { fly off in vapour, or
by fire { } or { in
 { } volatile { invisible particles.

Emit sparks, when struck { when red-hot
with steel, or with flint, { ——— cold.

Burn, when red hot, { colour of the flame.

Crackle, when exposed to heat

Detonate with coals

————— nitre

Tumefy, when exposed to heat, or to the flame
of the blow-pipe.

Effervesce by heat, with { Borax
 { Soda
 { Microcosmic salt.

Melt by heat { degree { by themselves,
 { of { or
 { heat { with other substances.

D

Melt

Melt { by themselves { degree
into { by different { of { colour.
glass { substances { transparency {

Calcine or oxydate by the assistance of heat.

———— without heat.

Become hard, when exposed to a strong heat.

———— brittle, ————

Effervesce with { alkalies { degree.
 { acids {

Soluble in acids.

Nitric acid, { with { quantity { colour
Sulphuric, { assistance { or { of
Muriatic, { of heat, or { proportion { solution.
Water, &c. { without {

Appearance on Evaporation.

Whether Coagulate,
 Crystallize,
 or Deliquesce.

Decomposed by other substances.

INSTRUMENTS.

Hard knife, hard file, steel, hammer, a small pair
of tongs, microscope or magnifying glass,
blow-pipe, agat mortar, electrometer, mag-
net, touchstone, goniometer, a small spoon of
platina, hydrostatic, and an essay scale.

A piece of diamond, a piece of ruby, fastened to
the ends of a small stick.

Metallic plates of { Copper
 { Iron
 { Tin.

Chemical

Chemical Menstruums.

Sulphuric, nitric, muriatic, acetous, oxalic, fluoric acid, and aqua regia.

Alcalies, { aerated { vegetable and mineral,
 { pure { fixed and volatile.

A solution of gold in aqua regia.

_____ of tin in aqua regia.

_____ lead in nitric acid.

_____ barytes in nitric and marine acid.

_____ silver in sulphuric and nitric acid.

_____ sulphate of iron.

_____ phlogisticated alkali.

_____ sal ammoniac.

Tincture of galls.

High rectified spirits of wine.

Nitre.

Calcined borax.

Microcosmic salt.

Soda.

Litmus paper

Turmeric paper.

Evaporating basins of stone and glass, funnels, filtering paper of white writing-paper freed from glue by boiling water, matrasses, lamp and furnace for assaying, &c.

CHAP. I.

MINERALS,

O R

SUBSTANCES FOUND UNDER THE
SURFACE OF THE EARTH.

THEY are generally divided into **FOUR**
different **CLASSES**, viz.

1. *The EARTHS.*
2. — *METALS.*
3. — *SALTS.*
4. — *INFLAMMABLE SUBSTANCES.*

There are also other substances, such as the carbonic acid, oxygen, or the basis of the pure air, &c. but which are invisible, and never found in their pure or separate state. They are only found united to other substances, or to heat, and are necessary to certain states of minerals; and hence, as they are found existing in the mineral kingdom, they ought not to be overlooked.

DEFI-

DEFINITION *of the different Substances which constitute the Minerals in general.*

CLASS I.

Of EARTHS.

Under the denomination Earth, we understand a concrete, friable, white, and opaque substance, which has no peculiar taste, is insoluble in five hundred parts of pure water, and whose specific gravity, compared to distilled water, does not exceed four or five times; is fixed in fire, not inflammable, does not exhibit a metallic lustre when melted with inflammable substances, nor produces inflammable air with acids.

There are now eight different kinds known, which differ from each other by some peculiar properties; five of which are known to be useful for some purpose or other, as the siliceous, argillaceous, calcareous, ponderous, and magnesia; and the other three, as the adamantine spar earth, circon earth, and australis, have not been yet applied to any useful purposes; but future experiments may discover their utility.

CLASS II.

Of METALS.

Under the name Metals, we comprehend those original solid mineral substances which are distinguished from all other known simple bodies by their density, by their specific gravity, in which they exceed all other known substances, by their peculiar lustre, ductility, malleability, and insolubility in pure water.

In the last century there were only eight metals known, but through the discoveries of our modern chemists, the number has now increased to eighteen, which all differ from each other by some peculiar properties.

Metals were generally divided into two classes; perfect, and imperfect or semi-metals. Under the first kind were understood such as would admit to be brought into the state of thin plates, or wire, without destroying their cohesion of particles, and which were called malleable, as gold, silver, copper, platina, iron, tin, lead. And under the semi-metals were understood such as would not admit such operation, which were called fragil, as antimony, bismuth, cobalt, &c.

CLASS III.

Of SALTS.

Salts in general may be distinguished by their property of being perfectly soluble in less than 200 times their weight of pure water, and by their being more or less transparent. They also crystallize, or recover their regular form, on gentle evaporation; and also by the peculiar sensation which they give to the nerves of the tongue, and which is distinguished by the name saline taste.

The salts are properly to be divided in three different general classes, as acids, alcalies, and into such as are composed of the two foregoing, and which are called neutral salts.

I. Of ACIDS.

Acids are distinguished; 1st, by their peculiar acid taste; 2d, by their property of changing the litmus paper or the juice of violets red; 3d, by occasioning an effervescence with such earths or alcalies as contain fixed air, or carbonic acid; and by producing neutral salts with alcalies, or metallic oxyds; by decomposing milk, and the solution of soap.

2. OF ALKALINE SALTS.

These are divided again ; 1st, into such as originates (as far as we know) from vegetables, and is called *pot-ash* or *vegetable alkali*; and 2d, such as originates from the mineral kingdom, and is called *soda*, or *mineral alkali*; and also such as originates, or is generally produced from animal matter, and which is called *volatil alkali*, (*ammonia*) on account of its being volatile when exposed to heat. The two first mentioned are not volatile in fire, and are therefore called fixed alkalies.

All these alkaline salts have the property of changing the blue juice of violets into green, and producing soap when boiled with fat or oil, to which they have an affinity. They combine with acids, and produce neutral salts when saturated with them. They have a greater affinity to acids than the earths, and therefore decompose the solution of any earth or metals in acids, &c.

3. NEUTRAL SALTS:

Neutral Salts are such substances as are composed of an alkali or metal saturated with acids. They show neither of the properties of the foregoing, because both their component parts become inactive, and their variety must be ascertained

tained by decomposing them, or by other chemical experiments.

CLASS IV.

INFLAMMABLE SUBSTANCES,

Are to be understood such substances as will burn and be consumed in common air, such as the coals, &c.

CHAP. II.

Of the DISTINGUISHING PROPERTIES

OF THE DIFFERENT

EARTHS, METALS, SALTS, &c.

Ascertained by Chemical Experiments.

CLASS I.*Of EARTHS.*

I.

CALCAREOUS EARTH.

Described by *Bergman*.

WHEN exposed to a strong heat, it is converted into quick lime.

It is soluble in nitric and muriatic acid, and forms deliquescent salts.

It is precipitated from the solution, by oxalic or by sulphuric acid, with which it forms felenite.

It melts perfectly with oxyd of iron, in the proportion as 4 to 1.

It adheres strongly to the tongue.

Diffolves readily with borax, and effervesces with alkali, when treated with the blow-pipe.

II. PON-

II.

PONDEROUS EARTH, or BARYT. Discovered by *Sheele*, 1774.

It is soluble in diluted nitric and muriatic acid; when saturated by these acids, it crystallizes, and the crystals do not deliquesce.

It is precipitated from its solution by sulphuric acid.

Also by prussiate of pot-ash.

It does not melt with oxyd of iron.

III.

MAGNESIA, or MAGNESIAN EARTH.

Described by *Valentine*, 1707, and by *Hoffman* and *Black*, 1755.

It is soluble in sulphuric, nitric, and muriatic acid; and forms, with the first, sulphate of magnesia, which has a bitter taste; and with the latter it forms deliquescent salts, which are soluble in spirits of wine.

It does not burn into quick lime.

It melts with borax.

And melts to a flux by oxyd of iron, in the proportion as 25 to 100.

IV.

ARGILLACEOUS EARTH. Discovered by *Margraff*, 1780.

It is soluble in sulphuric, nitric, and marine acid, and forms alum with the first.

It is soft to the touch.

It is precipitated from its solution by pure pot-ash.

It melts with oxyd of iron, in the proportion of 1 to 2.

Does not become soluble in water, when exposed to a strong heat like pure lime.

Becomes very hard by strong heat.

It has hardly any affinity to carbonic acid, when found native.

V.

SILICEOUS EARTH. It is not generally acted upon by acids, except the fluoric acid, but is somewhat soluble in acids, when in the state of precipitation.

It melts easily to glass, by pot-ash.

Melts by borax without effervescence.

The microcosmic salt hardly acts upon it.

It melts with oxyd of iron, in the proportion of 33 to 100; when in the state of quartz, it strikes fire with steel.

VI.

ZIRCON EARTH. Disc. by *Klaproth*.

Not soluble in alcalies, by fusion.

Soluble in sulphuric acid, without effervescence, and exhibits a gelatinous mass on evaporation.

Perfectly soluble with borax, without effervescence.

VII.

ADAMANTINE SPAR EARTH, CORUNDA. By *Klaproth*, in 1789.

Not soluble in acids.

Nor in alcalies.

VIII. AU-

VIII.

AUSTRALIS* SIDNEY EARTH. Discovered by
Wedgewood.

Is only soluble in muriatic acid, and is precipitated from the solution, by diluting it with water.

IX.

STRONTION EARTH.

Is soluble in marine and diluted nitric acid, it is precipitated from solution in those acids by sulphuric acid; when saturated with nitric acid, and evaporated, it crystallizes in hexagonal plates; with muriatic acid it forms long needle-shaped prismatic crystals †.

CLASS II.

Of METALS.

I.

GOLD.

ITS specific gravity is 19,000, compared to that of distilled water, at 60° Fahr.

It is best soluble in aqua regia.

* So called by Prof. Blumenbach.

† I also found that it has different affinities to acids (*which are mentioned on the table of affinities*) and which, together with the different crystallization as above mentioned, lead me to offer it as a new genus of earth.

May

May be discovered when in a state of solution, by adding a few drops of solution of tin to it, by the purple precipitate which is produced.

The solution leaves a purple spot upon the skin of the hands.

It is precipitated from the solution, by sulphate of iron, and not by sal ammoniac.

II.

PLATINA. Is described by *De Lisle* and *Sickingen*.

Its spec. grav. is $\approx 21,000$.

It is soluble in aqua regia.

The solution dyes the skin blackish.

Is not precipitated by sulphate of iron.

Is precipitated by sal ammoniac.

III.

SILVER. Its spec. gr. $\approx 10,000$.

It is readily soluble in nitric acid.

May be discovered, by a few drops of marine acid added to its solution, which unites with the silver, and separates in the state of a white precipitate, which has the peculiarity of becoming a blueish black, when exposed to light, and especially the light of the sun.

The solution of silver in acid dyes the skin black.

IV. COP-

IV.

COPPER. Its spec. gr. = 9,000.

Is soluble in most acids.

Is discovered by a piece of polished iron plate put into its solution, when the copper is recovered and deposited upon the plate in a metallic state.

Volatile alkali, or ammonia, extracts a blue colour, when digested with it in any state.

Phlogisticated alkali, when dropped into its solution in acids, produces a red precipitate.

When exposed to the action of the blow-pipe, it produces a glass, which first appears brown, and afterwards green.

V.

LEAD. Its spec. gr. = 11,000.

Is readily soluble in nitric acid.

May be discovered, by marine acid added to its solution, which produces a white precipitate, which does not change its colour, when exposed to light, and which is soluble in 24 times the weight of distilled water.

The solution tastes sweetish.

When exposed to the action of the blow-pipe, produces a glass.

VI.

MERCURY. Its spec. gr. = 14,000.

Is soluble in nitric acid.

May

May be discovered by a polished plate of copper placed in the solution, upon which the mercury will be deposited in a metallic state, so that the recovered particles may be discovered, by means of a magnifying glass.

VII.

TIN. Its spec. gr. = 7,000.

Is readily soluble in aqua regia.

Also in nitrous acid, but is spontaneously separated again in the state of a white calx.

May be discovered in the state of solution, by adding a few drops of solution of gold, with which it produces a purple precipitate.

Phlogisticated alkali dropped into its solution, occasions a precipitate, which appears first greenish, but changes into blueish white.

VIII.

IRON. Its spec. gr. = 7,200.

Soluble in sulphuric and muriatic acids, &c.

May be discovered on dropping a little phlogisticated alkali into its solution, which produces a blue precipitate.

Caustic volatile alkali dropped into its solution produces a yellowish brown precipitate.

When in the metallic state, is attracted by the magnet.

IX. ZINK.

IX.

ZINK. First described by *Albertus Magnus*, in 1280, also by *Henkel & Lawson*.

Its spec. gr. = 6,800.

It burns with a bluish green flame, when exposed to red heat, and sublimes in the state of a white light substance.

It precipitates lead, and other metals, in a metallic state, from their solution.

When in an oxyd state, is recovered by charcoal in a close vessel.

X.

BISMUTH. Discovered by *Agricola* and *Schroeder*, in 1641.

Its spec. gr. = 9,600.

Is soluble in nitric acid, but separates again, on diluting the solution with much distilled water.

It produces a brown glass, with borax, when exposed to the action of the blow-pipe.

Phlogisticated alkali dropped into its solution, produces a pale green precipitate.

XI.

ANTIMONY. Discovered by *Basil. Valentine*.

Its spec. gr. = 6,800.

Is soluble in aqua regia, but is precipitated again by mere water.

E

Phlo-

Phlogisticated alkali dropped into it, produces a blue precipitate, which changes soon into a deep olive green.

Tincture of galls produces a grey precipitate.

It calcines and sublimes in the state of a white powder, when exposed to heat.

XII.

COBALT. Described first by *Brandt*, in 1735, and by *Lehman*.

Its spec. gr. = 7,700.

Is soluble in sulphuric and nitric acid.

The solution appears of a rose-colour.

Phlogisticated alkali added to its solution, produces a blue colour; and tincture of galls, the same.

Pure or caustic pot-ash, produces a reddish precipitate.

When melted with borax, produces a blue glass.

Dissolved in aqua regia, makes sympathetic ink.

XIII.

NICKEL. Described by *Cronstedt*, in 1751, and *Bergman*.

Is soluble in nitric acid.

The solution appears deep green.

Ammonia or volatile alkali, extracts a blueish colour from it.

Phlo-

Phlogisticated alkali added to its solution, produces an emerald green, changing gradually to a yellowish brown, precipitate.

A polished iron plate held in its solution, produces no precipitate.

When melted with borax, produces a hyacinth-coloured glass.

XIV.

MANGANESE. Discovered by *Gahn*, in 1777.

Its spec. gr. = 6,840.

Is soluble in marine acid, by the addition of a little sugar.

The solution appears brown.

Is discovered by adding a little common marine acid to it, which, by the assistance of heat, produces the smell of dephlogisticated muriatic acid air.

Produces pure air, when exposed to red heat in a close vessel.

Treated with borax, by means of the blow-pipe, produces a glass of a purple colour.

XV.

ARSENIC. The Metal first discovered by *Schroeder*, in 1641, and by *Monnet*, in 1773.

Its spec. gr. = 8,300.

May be discovered, by exposing a piece of it upon red-hot coal or iron, by means of which, a garlic smell is emitted.

The fumes will deposit a white coating on a plate of copper.

When phlogisticated alkali is dropped into its solution, it produces a green precipitate.

XVI.

WOLFRAM. Discovered by *Messrs. de Lu-yarts*, in 1783.

Its spec. gr. is = 17,6.

Is very brittle.

Difficult to fuse.

On scraping its surface, appears reddish.

It effervesces with microcosmic salt, when exposed to the action of the blow-pipe, and produces a pale red glass; with borax, a green, by the internal, and a red, by the external flame.

XVII.

MOLYBDENA. Discovered by *Hielm*, in 1784.

Its spec. gr. = 6,000.

It melts easily, is volatile by moderate heat, effervesces with alkali, and emits a sulphureous smell, when treated with the blow-pipe.

Is not affected by nitric acid, except by the assistance of heat.

Scarcely

Scarcely affected by borax or microcosmic salt.

XVIII.

URANIUM. Discovered by *Klaproth*, 1790.

Its spec. gr. = 6,440.

Soluble in nitric, sulphuric, and marine acid. Is not precipitated by zink. Phlogisticated alkali added to the solution, produces a deep red precipitate.

C L A S S III.

Of ACIDS

I.

SULPHURIC ACID. This may be discovered by adding a few drops of a solution of muriate of baryt to any liquid containing that acid, when a precipitate takes place, occasioned by the strong affinity of sulphuric acid to the ponderous earth; or by decomposing substances containing that acid, by means of pot-ash, with which it forms the vitriolated tartar.

II.

NITRIC ACID. When mixed with pot-ash, detonates upon red-hot charcoal; when in a separate state, dissolves silver, &c.

III.

MURIATIC ACID. This may be discovered by adding a few drops of solution of sulphate of silver to any liquid containing that acid, when a white precipitate will take place, namely, luna cornua.

IV.

PHOSPHORIC ACID. This may be discovered by its vitrifying and phosphorising nature, when exposed to the action of the blow-pipe.

V.

BORACIC ACID. This is soluble in spirits of wine, and burns with a green flame when kindled. It is precipitated from its combination with soda, as in borax by sulphuric acid.

VI.

ARSENICAL ACID. This may be discovered by the smell of garlic which it emits when exposed to heat.

VII.

FLUORIC ACID. This may be discovered by mixing a little concentrated sulphuric acid, to a substance containing that acid, and

and exposing it to a little heat, when vapours will be disengaged which affect glass immediately.

ALCALINE SALTS.

I.

VOLATILE ALCALI or AMMONIA. This may be discovered by its pungent smell, which is produced when a substance, containing that alkali, be mixed with quicklime or pot-ash.

II.

SODA or MINERAL ALCALI. Decomposes when exposed to air, or loses easily its crystallizing water, forming glauber salt with sulphuric acid; and with other acids, it forms salts which do not easily deliquesce.

III.

VEGETABLE ALCALI or POT-ASH. Deliquesces when exposed to air, and does not crystallize.

All these alkaline salts decompose solutions of earths and metals in acids.

 C L A S S I.

INCLUDING

EARTHS and STONES.

 G E N. I.

ZIRKON by the GERMAN, and *JARGON*
by the FRENCH.

S P E C. I.

THIS substance is found in small grains, and in small flat pebbles. Of various colours, viz. greenish, grey, reddish green, brownish, and hyacinth red.

Its regular shape, according to Romè de Lisle, is an equal-sided octaedron; the two pyramids are separated by a small prism.

The pyramids are more obtuse than those of the diamond and ruby; it is the only kind of the gems in which the pyramids of the octaedron are separated by rectangular prisms.

Its

Its specific gravity compared to distilled water at 60°, is = 44,160.

It scratches glass; is not altered in fire by that heat in which the diamond is consumed.

According to *Klaproth*, it yielded by analysis 68 grains of circonia, 31 of siliceous earths, one grain of iron.

Another chemist found it containing also a little trace of nickel.

It is found at Brasil and Ceylon.

Was first taken for a kind of diamond, but was made a peculiar genus by *Werner*.

GEN. II.

ADAMANTINE SPAR. CORRUNDUM.

Fr. *Spath Adamantin.*

Germ. *Diamant Spath.*

Its colour is generally greyish, inclining to greenish white, chocolate brown, &c.; is of a lamellated texture.

It cuts glass like diamond, and scratches other gems; strikes fire with steel; is not affected by sulphuric, nitric, or marine acid.

Its regular figure exhibits six-sided short rhomboidal prisms, rounded on the top, of a lamellated texture, shining in certain directions.

Its specific gravity = 3,710, sometimes 3,908.

Mr. *Klaproth* found it to consist of 22 parts of a peculiar earth, which he called corunda earth, of 64 argillaceous earth, a little iron and nickel.

It

It is found in Bengal, Bombay, and in China, generally in a granit mixture of mica and feldspar; sometimes accompanied with black shorl, or crystals of magnetic iron stone.

It is used for polishing gems, and other hard stones.

G E N. III.

SILICEOUS GENUS.

The substances which are included under this genus, and particularly in the first part, exhibit mostly a vitreous appearance, possess a high degree of hardness, and for the most part a great degree of transparency; they are scarcely affected by any other acid than the fluoric.

They are generally composed of siliceous, argillaceous, and a little calcareous earth and oxyd of iron; they seldom contain oxyd of other metals, or baryt earth.

Most of them strike fire with steel.

The first part includes chiefly the stones which are classed with the gems, and which are almost all electric, though in different degrees.

S P E C. I.

SAPPHIRE. In Latin *Saphirus*; Greek, *σάφειρος*; Hebrew, *ספודיר*, (the stone worn by the high priest of the Jews.)

By

By WALLERIUS, *gemma pellucidissima duritie
tertia colore cæruleo vel cyano, igne fugacius.*

By CRONSTEDT, *Saphirus gemma.* By Romè
de Lisle, *Ruby.* The other Synonima,
vide Syst. Nat. Lin. edit. Gmel.

Its colour is sky blue, or the shades of Prussian
and indigo blue, seldom inclining to pink.

It loses part of its colour by strong heat.

Its spec. gr. = 3,780 to 4,000.

Is next in hardness to the diamond.

It is found in grains, in obtuse angular
pieces, in sand and rivers; is also found of a rhom-
boidal figure.

Its regular figure is the dodecaedron, com-
posed of two longish hexagonal pyramids, joined
by their basis. The pyramids sometimes trun-
cated on the points.

The crystals are strong—shining; exhibit a la-
mellated texture, transversely striated. They be-
come colourless when melted with microcosmic
salt.

Some kinds yielded by analysis, (Bergman)
58 argillaceous, 35 siliceous, 0,5 calcareous
earth, and 0,02 iron.

The best kind is very dear. A piece of 10
carats was valued at 50 guineas, and one of twenty
carats, at two hundred pounds. Those which
come from Persia are somewhat greenish, and
very scarce.

Those

Those of an opalescent nature are less esteemed.

The greatest quantity come from the East Indies, from Pegu and Ceylon.

Some are found in Saxony, Bohemia, and Siberia, but are of less beauty and value.

If one ounce of flint glass is mixed with two grains of oxyd of cobalt, and melted, it produces a glass similar to the sapphire in colour, called false saphir.

SPEC. II.

RUBY. By CRONSTEDT, *Adamas ruber*, Carbunculus of Pliny.

By WALLER, *gemma pellucidissima duritie secunda colore rubro in igne permanente*.

VAR. I. TRUE RUBY.

Silex rubinus verus. Syst. Nat. L. nov. edit.

By the German, *Aechter Rubin*.

Its colour is crimson, or deep red, which it retains in fire.

It is found in angular pieces, in small pebbles, and of regular shape, as octaedron, or in double 4-sided, seldom 6-sided, pyramids.

Its spec. gr. = from 3,760 to 4,283.

It yields by analysis, 39 filiceous, 40 argillaceous, 9 calcareous earth, and 10 of oxyd of iron.

The

The best kinds are brought from the East Indies, from Pegu, Ceylon, Brasil, Calcutta, Cambaja.

Some are found of the shape of the Topaz of Brasil, which are supposed to be such, having only been altered by fire. This can be proved, on exposing the Topaz in a crucible with wood-ash to a strong heat, by which means it obtains that red colour. This experiment was discovered by Mr. Guetard, and communicated to the Royal Academy at Paris, by *Dumell*, a jeweller.

The best true rubies are very dear, almost equal to the red diamonds.

It is said that Queen Elizabeth of Austria made a present of one to her brother the Emperor Rudolph, which was valued at 6000 ducats.

They are ground upon copper plates with emery, and afterwards polished with tripoli; but the spinell is polished with tripoli and spirit of vitriol, or diluted sulphuric acid.

VAR. 2. SPINELL, or *Balais* by the French,

Is not quite so hard, differs from the other in the colour, which is inclining to rose colour, but which is destroyed by a strong heat, and is said to contain less siliceous earth.

S P E C.

SPEC. III.

TOPAZ *. So called in most languages.

By WALLERIUS, *gemma pellucidissima duritie quarta colore aureo in igne fugace.*

By CRONSTEDT, *Topazius gemma*, and by other writers, vide Syft. Nat. L. edit. nov. Gmel.

Its colour is various.

Those from the East Indies, which are called the true oriental, are almost colourless; those from Brasil exhibit the colour of the fine yellow transparent amber, and those from Saxony yellowish white.

The East Indian Topazes melt easily with borax, and increase in weight when strongly heated.

VAR. I. BRASIL TOPAZ.

Its specific gravity = 3,564.

It yields by analysis, 52 of siliceous, 44 of argillaceous, 2 of calcareous earth, and 0,31 iron.

It scratches hyacinth and rock-cryftal; though its surface can be scratched by diamond, sapphire, and ruby, yet its primitive figure is, according to Romè de Lisle, an octaedron. It generally exhibits a four-sided rhomboidal prism, terminating from the sides in flat four-sided pyramids, longitudinally striated, and of a foliaceous texture.

* From the Greek word Topazion.

That kind which is called the Pink, by the Indians, exhibits generally six-sided prisms, terminating in three-sided pyramids, the base of which exhibits a triangle with the points truncated.

VAR. 2. The SAXON TOPAZ, called by La Metherie *Chrysoberill*, found at Schneckenstein, in rocks composed of quartz, black bar shorl, and lithomarge.

Its regular figure exhibits rectangular four-sided short prisms, the side edges truncated, the faces of the truncation are generally smaller than the principal side faces; the broad sides describe a right, and the small faces, an obtuse angle. The end terminates generally in a six-sided pyramid, truncated on the point, the faces of the acumination are mostly pentagonal, and those of the truncature, hexagonal.

Is scratched by sapphire; is less hard than the oriental. Is found in masses of rock crystal, in an inclined position, upon the surface of the matrix.

It loses its colour entirely in fire.

It yields by analysis (according to Bergman) 46 argillaceous, 39 siliceous, 0,8 calcareous earth, and 0,6 of iron.

They are set in rings when finely polished, and also often in buckles, for which purpose they

they are first exposed to heat, in order to deprive them of their colour.

S P E C. IV.

HYACINTH. So called in most languages,
from the GREEK *ὑαζινθος, λυγγεριον;*

Lynkur by THEOPHRAST.

WALLER. *Topazius flave rubens.*

Its colour is a peculiar yellowish red. Most of the hyacinths retain their colour in fire. Those which are of a candied honey colour are less esteemed.

The hyacinths are found in the form of pebbles, in obtuse angular pieces. Its regular figure exhibits a dodecagon with unequal rhomboidal faces. The eight faces which compose the two pyramids have an acute angle of 73° , and the obtuse of 107° . The four rhombs of the prism have their acute angle $= 65^{\circ}$ and their obtuse $= 115^{\circ}$.

The rhombs of the prisms are sometimes longish, and in that case their figure appears hexagonal, changing alternately with the rhombs of the pyramids.

More varieties of crystallization are described in Brückman's book, *Von den Edelsteinen.*

The

The crystals are small, have a smooth surface; a lamellated texture; a high lustre; break in indeterminate pieces, mostly transparent.

Their spec. gr. = 3,667.

They are harder than emeralds and quartz.

When exposed in a crucible, surrounded by wood ashes, to a strong heat, they lose most of their colour, and are, in that state, often sold for diamonds.

The hyacinths are smoothened first upon a leaden plate with emery, and polished with tripoli.

One hundred grains of hyacinths have yielded by analysis, according to *Bergman*, 40 grains of argillaceous, 20 of calcareous earth, and 13 of oxyd of iron.

They were formerly used in medicine, as a specific; and the electuary of hyacinths is still kept by some apothecaries, who are ignorant enough to attribute medicinal effects to it.

They are brought from Ceylon, Peru, Arabia, Calicut, Cambaja, Nortschinsk,—from the Uralian mountain in Siberia, and also from Switzerland and Bohemia.

They are imitated by heating rock-crystals, and putting them into a solution of dragons blood, or by a fusible mixture of one ounce of flint glass, and 24 grains of colcathar of vitriol of iron.

F

VAR.

VAR. 2. HYACINTHINE, or volcanic hyacinth
—by *La Metherie*.

This variety is less hard than the real hyacinths.

Its regular shape exhibits a 4-sided prism, having the angles always truncated, which make it appear a suboctaedron, terminating in a 4-sided pyramid, with pentagonal faces.

It melts easily, whilst the oriental hardly melts at all.

Its colour is generally deeper than the oriental.

It is generally found in volcanic products.

SPEC. V.

AQUAMARINE, BERYL. These names were promiscuously given to a kind of topaz, of a mountain green colour, and were considered as different species, but are now ascertained to be the same; the name Aquamarine seems to be the most proper on account of the colour.

It is found in Siberia.

It exhibits large perfect 6-sided prisms.

Is also found in Saxony, at Johanngesorgstadt, in the mine called *Frisch Gluck*; but this kind differs from the Siberian in being less transparent, and in not exhibiting so fine a colour.

When

When rubbed it attracts light substances, as ashes, hairs, and paper; it is not altered by the flame of the blow-pipe.

Mr. Bindheim found it contained 24 argillaceous, 8 calcareous, 64 siliceous earth, and $1\frac{2}{3}$ iron.

The following description of the latter kind, is given by Mr. Hoffman:—

The beryls exhibit a pale mountain green colour; adhere by the side faces to the matrix, which shines through the crystals. The crystals always exhibit a 6-sided prism on a steatitical matrix, and are of various sizes. The surface is longitudinally striated, a little shining, of a lamellated texture; when transversely broken, semitransparent, and brittle.

S P E C. VI.

EMERALD. *Smaragdus*, from the Greek word *σμεράσσω*, shining, reflecting.

By the German *Smaragd*; in French *Emeraude*.

WALLER. *gemma pellucidissima duritie sexta colore viridi subflavo, &c.*

CRONSTEDT, *Topazius Chrysolithus*.

By the Romans called the *Neronien* or *Domitian Gem*.

In Persia and India, called *Pacha*.

By the Arabians *Zamaruth*, vide Syft. Nat. L. Edit. Gmel.

Its colour is pure green, which it loses in fire, as also some of its weight.

It is found in hexagonal prisms, either perfect or truncated on the angles or edges, terminating in truncated pyramids.

The crystals are mostly smooth on the surface, shining and transparent, in various degrees.

It is reckoned the softest of the gems, but seems to be harder than the rock crystal.

Its spec. gr. = 2,775.

It yielded by analysis 24 parts of siliceous, 60 argillaceous, 8 of calcareous earth, and 6 of iron, from which it has the green colour.

The light green-coloured emerald is called the Oriental or East Indian kind, and is reckoned the best.

Its matrix is generally either quartz or calcareous spar.

The finest specimen is said to be in the treasury of the Holy Chapel near Ancona.

Emeralds are brought to us from Ceylon, Pegu, Egypt, Brasil, and Peru.

Some are found in England, Italy, Germany, Hungary, Bretagne, &c.

The brown kind, Romé de Lisle has called the Peridot.

They are imitated by a mixture of one ounce of flint glass, and 5 grains of calx of copper.

SPEC.

SPEC. VII.

GARNIT. German *granat*.

CRONSTEDT, *granatus martialis?* & *granatus crocis martis*, & *jovis mixtus*.

WALLER. *granatus crystallifatus pellucidis rubens nitens in igne colorem retinens, lapide liquescente*.

The garnits generally exhibit a red colour, or some of its shades; also greenish, white, and are of various degrees of transparency.

They are found in quartz, granit, gneiss, micaceous schistus, serpentine, also in vitreous copper ore. They are seldom found of a black colour, as in the white feldspar of Iceland.

It is said the name garnit was given on account of their colour, which resembles the flowers of the pomegranite tree.

Its spec. gr. = 4,100 to 4,412.

According to Romé de Lisle, its variety of shape seems to derive from a rhomboidal parallelopiped, terminating in 6 equal rhombs, the acute angles of which describe 70° , and the obtuse 110° , the parallelopiped compressed so as to exhibit two three-sided obtuse pyramids; the edges of one of the pyramids crossing the faces of

the opposite. The angle of the point of the pyramids is $= 125^\circ$, which gives 55° for the angle of the base, corresponding on the two faces; from which it becomes clear, that when 4 of these primitive figures unite, they will exhibit a dodecagon, which may be considered as a six-sided rhomboidal prism, terminating in three-sided pyramids.

The following varieties with regard to its shape are frequently found.

1. Dodecagon with rhomboidal faces.
2. Exhibiting 24 faces, consisting of two eight-sided truncated pyramids.
3. Exhibiting 36 faces; the 12 large are rhomboidal, and the 24 smaller ones hexagonal.
4. Of 18 sides, consisting of a short six-sided prism terminating in two six-sided pyramids, &c. Vide *Romé de Lisle*, and *La Metherie*.

They do not lose their colour in fire, but become heavier, and are strongly attracted by the magnet.

They are found in various countries,—in the East-Indies, America, Ceylon, Cambaja, Syria, Armenia in Europe, Norway, Switzerland, Greenland, Siberia, Spain, Tyrol, Hungary, Bohemia, Saxony, &c. Those from Tyrol generally exhibit from 4 to 24 faces.

They were formerly much worn by ladies round the neck.

They

They are cut at Freyburg, and polished upon lead plates, with emery, tripoli, and spirit, or diluted acid, of vitriol.

They were used in medicine for various purposes.

The red garnits are moved by the magnet, and generally yield, by analysis, 48 parts of siliceous, 30 argillaceous, 11 calcareous earth, and 10 of iron.

The green kind contain, according to Wiegleb, more iron than the other kinds, but no argillaceous earth.

The common garnits in Saxony, &c. are, on account of their being so easily fusible, mixed with iron ores, to render them more fusible.

There is another variety of garnits, which are white, and always exhibit 24 trapezoidal faces. One sort is found in volcanic productions, lava, and tuffwakke, &c. which seems to have lost its colour by the subterraneous fire and sulphureous acid; but there is another kind, which seems not to have been thus altered, and which yields, on analysis, according to Bergman, 55 siliceous, 39 argillaceous, and 0,9 of calcareous earth, but no iron. This kind is not fusible by fire, like the red.

The red appearance of garnits may be imitated by a fusible mixture of 256 parts of flint glass, 128 gr. oxyd of antimony, 1 part oxyd of gold, and 1 of manganese.

SPEC. VIII.

CHRYSolITH. So called in most languages.

Goldstein in German.

By CRONSTEDT, *Topazius crysolithus*.

By WALLER. *gemma pellucidissima, duritie sexta colore viride subflavo in igne fugaci.*

The Ancients gave this name to almost all stones of a yellowish green colour, without making any distinction with regard to figure or component parts; they took the topaz for crysolith, and the crysolith for topaz.

The name originates probably from the Greek χρυσο λίθος.

The crysolith exhibits a yellowish green colour, sometimes inclining to yellowish brown.

It is always found crystallized, and its regular shape exhibits a hexaedral flattened prism, terminating in six-sided pyramids, and therefore approaching to the figure of the rock crystal, but with this difference, that their pyramids are more flat or obtuse. The angles of the points of the rock crystal describe 40° , and those of the crysolith 50° . The angles formed by the pyramid and the face of the prism are 130° , and by the rock crystal 142° . The prism is sometimes truncated, when it exhibits a dodecaedron.

dron. The crystals are longitudinally striated on the broad side faces, and the rest are smooth, transparent, and of a vitreous lustre.

Romé de Lisle says, that those which are brought from the East, exhibit a longish unequal-sided prism, terminating on both ends in a four-sided cuneiform pyramid. They do not lose their colour in fire.

Their spec. gr. = 3,098.

They yield on analysis 15 parts of siliceous, 64 argillaceous, 17 calcareous earth, and 1 of iron.

They are found in the East Indies, at Brasil, Spain, Saxony, and Bohemia.

Some are found in lava in the Vavarre, sometimes of 20 or 30 pounds weight.

The chrysoliths are ground with emery upon leaden plates, and polished with tripoli and diluted sulphuric acid, upon tin plates.

They are imitated by a fusible mixture of 2 ounces of flint glass, 8 drams of red lead, and 12 grains of oxyd of iron.

SPEC. IX.

OLIVIN, SILEX OLIVINUS, also called
Volcanic Chrysolith.

Its colour is olive green and asparagus green : the latter kind is called *Augit*, and found crystallized

crystallized in 6, seldom in 4-sided prisms, mostly rectangular, with or without pyramids.

The crystals are longitudinally striated; have a vitreous appearance; scratch rock crystals, but less hard than the crysolith.

They yield on analysis, according to Gmelin, $54\frac{1}{2}$ of siliceous, 40 of argillaceous earth, and 0, 3 of iron.

Are found imbedded in basaltes.

Their colour can be extracted by nitric acid.

SPEC. X.

CROSS STONE or CROSS CRYSTAL.

Fr. *Pierre de Croix*. In Germ. *Kreuzkrystal*.

By ROME' DE LISLE called *Skorles Cruciformes*, described in his 2d vol. of *Crytalography*, and delineated upon plate VII. fig. 38, 39, 40, 41, &c.

One kind is found at Andreasberg on Harz, which by La Metherie is called *Andreasbergolite*.

Its colour is greyish brown, sometimes reddish brown, and seems to be composed of two flat 4-sided

4-sided prisms, cuniated and acuminate on both ends, intersecting each other at right angles. Romé de Lisle *Cryſtal.* plate IV. fig. 119.

The cryſtals ſtrike fire with ſteel, and ſome of them ſcratch glaſs; are ſoluble in nitric acid, and yield on analyſis, according to Weſtrumb, 44 ſiliceous, 20 argillaceous earth, 20 of ponderous ſpar, and 16 of water.

Another kind is called by La Metherie *Staurolite*, from the Greek name *Stouros* and *Litos*. Found in Bretagne in France, at Compoſtella in Gallicia, and deſcribed by *Robien*. Is found in blackiſh ſchiſtus: one he calls the true croſſ-ſtone, compoſed of ſix-sided prisms cutting each other generally at right angles.

The prisms are truncated, and without pyramids. Another variety exhibits a 4-sided rhomboidal truncated prism, the acute angles of which are $=$ to 85° , and the obtuſe $=$ 95° . The prism, when tranſverſely cut, exhibits a croſs, whoſe diviſions proceeding from the angles, are marked by a blackiſh ſubſtance; the interior ſubſtance appears of a yellowiſh grey colour.

SPEC. XI.

SHORL, SCOERL (*Cockle*, which seems to be an old Cornish name). Lat. *Silex Scorlus*. This substance has been differently arranged; but I thought it would be best to place it among the siliceous stones, from its resemblance to them in most of its properties.

Most varieties of it strike fire with steel, and scratch glass; have a vitreous appearance, but melt easily into a spongy glass.

It is generally composed of vitrifiable and calcareous earth, and contains less iron than the garnets, and very seldom discovers a trace of magnesia. It is not acted upon by diluted nitric acid with effervescence.

It is found of various colours, red, black, greyish white, but generally green; is also transparent in different degrees.

The general shape which the shorl exhibits, is a six, or nine-sided prism, with three-sided pyramids.

Romé de Lisle describes its general figure as a much compressed rhomboidal parallelopiped, and considers it as a six-sided lenticular crystal, formed by two three-sided pyramids joined by their

their bases in such a manner, that the edges of one pyramid cut exactly the faces of the opposite.

The rhombs of the parallelopiped have an acute angle $= 66^\circ$, and an obtuse $= 114^\circ$; they resemble in shape the lenticular calcareous spar.

Romé de Lisle and La Metherie divide the shorls into two general classes, the transparent and opaque. Most of the transparent kind are electric when heated to about 200° Fahrenheit. Some shew this property on being brought out of a cold into a warm room, but never when they have obtained the temperature of the room.

The spec. gr. is generally $= 3,000$.

TRANSPARENT SHOERLS.

VAR. 1. PERIDOT, which was formerly placed under the gems, but was found by Romé de Lisle to be a shorl.

Its colour is a yellowish green.

Its general figure exhibits a striated six-sided prism, terminating in three-sided pyramids, with pentagonal faces. The prism has sometimes 9 sides, which are variously shaped.

Is found in Ceylon.

SPEC.

VAR. 2. TURMALIN, from Brasil. Syft. Nat.
L. ed. Gmel. *Scorlus genuinus*.

WALLERIUS, Syft. Min. *Basaltes figura colum-
nare, &c.*

CRONSTEDT, Min. *Basaltes chrystallifatus*.

Its colour is deep green.

It exhibits six or nine-sided prisms, longitudi-
nally streaked, and terminating in three-sided py-
ramids with pentagonal faces.

Its spec. gr. = 31,500.

It does not strike fire with steel.

The surface can be scratched with a hard
knife.

It melts *per se* by means of the blow-pipe.

Is acted upon by nitric acid; is very little
electric; a particular kind is attracted by the
magnet.

Its matrix is generally granit, gneifs, &c.

VAR. 3. TURMALIN from Zeylon, *Ashen-
drower*. Syft. Nat. L. ed. Gm. *Schorlus
electricus*.

WALLERIUS, *Zeolites facie vitrea, &c.*

This variety is most electric, and is said to
be the first in which this property was dis-
covered

covered by Lemery in 1717, by a piece of it having accidentally fallen into the ashes of the furnace.

It was brought to Europe by the Dutch.

Its colour is generally deep red brown, seldom red or bluish.

Its spec. gr. = 30,541.

Its hardness is equal to the foregoing variety.

It exhibits six and nine-sided prisms, terminating in two three-sided pyramids with pentagonal faces.

The faces of the two pyramids proceed alternately from the faces of the prism.

It melts difficultly.

It is electric, when heated to 200° Fahr. at this heat attracting light bodies by one end, and repelling them by the other.

If one end be heated, and the other cold, it attracts then on both ends.

It exhibits the electric power when exposed to a sudden change, by removal from a cold into a warm room.

It is not readily acted upon by sulphuric, nitric, or muriatic acid.

It is laterally transparent, but not longitudinally, owing to the peculiar texture or position of the particles.

It yields by analysis, according to Bergman, 37 parts of siliceous, 39 argillaceous, 15 of calcareous.

careous earth, and 0,9 of iron. Is found in the rivers at Zeylon, &c.

VAR. 4. TURMALIN, from Tyrol.

This kind was first discovered by Muller, in 1778; found in steatite rocks, on the high mountains in Tyrol. When held to the light it appears deep brown, but in thin lamellæ it appears deep green.

Its spec. gr. = 30,470.

Is a little harder than the foregoing kind.

It exhibits long three-sided prisms, longitudinally streaked; the prisms appear sometimes six or nine-sided by a simple or double truncation. The prisms terminate in three-sided pyramids, which are seldom discovered, as the ends appear generally roundish.

This kind yields by analysis, according to Bergman, 40 parts siliceous, 42 argillaceous, 12 calcareous earth, and 0,6 of iron.

VAR. 5. TURMALIN, from Spain.

This kind was first discovered by Mr. Launoy, in 1782, in the mountains near Castille in Spain.

It resembles much that from Tyrol, both in transparency, colour, hardness, and specific gravity.

It

It melts, by long exposure to an intense heat, into a white vitreous mass, owing to the small quantity of iron which it contains.

VAR. 6. GREEN SHORL, from Dauphiné; discovered by Mr. De Bournon, in the mountains of Boury d'Oison, in Dauphiné.

Its spec. gr. = 34,529.

It scratches glass, and is found crystallized in long striated prisms, with indeterminate faces.

Another kind is found in the Zitterthal in Tyrol, in reddish steatite, of equal degree of hardness with the turmalin, crystallized in six-sided prisms without pyramids.

Mr. Bergman found it containing 64 parts of siliceous, 0,3 argillaceous, 20 magnesia, 0,9 calcareous earth, and 0,4 of iron.

VAR. 7. RED SHORL.

Fr. *Shorl rouge.* Germ. *Rother Shorl.*

This kind has been found in small crystals upon quartz, &c. In figure it resembles shorl.

Romè de Lisle describes its crystals as lenticular, composed of two four-sided prisms without pyramids.

VAR. 8. WHITE SHORL.

Is found at Altenberg in Saxony, and also in Tyrol, and in the Pyrenees.

It is generally milk white, somewhat semi-transparent, and exhibits long striated rhomboidal four-sided prisms, which scratch glass, but are very brittle.

It seems to be composed of equal parts of quartz and argillaceous earth; I found the matrix of the same colour and nature, only the particles are not regularly shaped, and appear like a loose white sand-stone.

I have a specimen of a micacious rock in my collection, containing two different substances, one of which exhibits properties and appearances of shorl.

One of these substances lays close over the other, in the same direction; both are of the same magnitude and length. One is of a brown red colour, strong — shining, smooth on the surface, semi-transparent, scratches glass, is not scratched by a hard knife, strikes fire with steel, exhibits long four-sided rhomboidal compact crystals, which are not acted upon by the nitric acid.

The other crystal is pearl white with blue shades, and seems rather to be composed of long rectangular plates, which are brittle, and break short. The crystals are not acted upon by the nitric, or muriatic acid. It seems to belong to the mica-

cious kind. When exposed to the blow-pipe, it does not melt *per se*, but loses its colour.

I shall submit both these specimens to an analysis, in order to ascertain what genus of stones they properly belong to.

The following varieties include, according to Romé de Lisle and La Metherie, the opaque shorls.

VAR. 9. BLACK OPAQUE SHORL. Is found in granit and gneiss, sometimes disseminated through granit in very small particles.

It is also found crystallized in long striated prisms of various sizes, sometimes an inch in diameter, and several inches long; such is found in Bretagne in granit. It is also frequently found in serpentine.

1. The shorl from Madagascar exhibits a hexaedral prism, terminating by two regular three-sided pyramids, proceeding from the alternate side faces. The pyramids are sometimes truncated on the points, resembling the Turmalin from Zeylon.

It melts easily *per se*, and exhibits a greyish white glass. According to Wiegleb it contains 41 siliceous, 38 argillaceous, 17 of iron; but he found the proportions different in different specimens.

2. The striated opaque shorl exhibits long prisms with many striæ running parallel on the axis of the prism; it is difficult to ascertain the number of sides; six or nine sides are generally discovered; its figure resembles much the Turmalin from Spain and Tyrol.

Its spec. gr. = 30,926.

VAR. 10. RED OPAQUE SHORL, found in mountains in Hungary.

It exhibits lenticular crystals with rhomboidal faces, the pyramids having three sides, and one of the edges truncated, thereby exhibiting an hexagonal figure.

There is another variety of red shorl from Siberia, in white transparent quartz, exhibiting needle-shaped crystals, found near Catharinenburg, and called there spinel garnit, &c.

Its colour is blood red, crimson, peach flower. Is generally found in fibres adhering to each other; it strikes fire with steel, and scratches glass.

Its spec. gr. = 3,100.

It loses its colour in fire.

According to Bindheim, it contains 57 gr. siliceous, 35 gr. argillaceous, half a gr. oxyd of iron and manganese.

VAR.

VAR. II. VOLCANIC SHORL, found in volcanic products, as in the lava and pouzolanes.

This shorl has a peculiar appearance; it is not proved yet, whether it has obtained its shape by fusion, or existed in that state before it came in contact with the fluid or melted lava, as we find some crystallized feldspar in those products. It cuts glass.

Its spec. gr. = 32,265.

Romè de Lisle derives its regular figure from a rhomboidal octagon, with truncated pyramids, which sometimes resemble a dodecagon.

That kind from Albano yields by analysis, according to Bergman, 58 siliceous, 27 argillaceous, 0,4 calcareous, 0,11 magnesian earth, and 0,19 iron.

VAR. 12. FIBROUS OPAQUE SHORL.

This is composed of small long prismatic compressed crystals, like the fibrous zeolith, the fibres laying parallel. Some kinds resemble the fibrous asbestos. With this kind may be arranged the *stangen shorl*, so called by the Germans, which is composed of compressed long prisms, sometimes parallel, sometimes diverging. This kind is not so hard as the other shorls.

VAR. 13. LAMELLATED SHORL. *Hornblende, Shorlblende.* So called by La Metherie.

Its colour is generally black and deep green. It is found solid, interspersed, and in prismatic crystals.

Its spec. gr. = 29,000.

It is less hard than the real shorls.

It differs from the shorls in containing magnesia. According to Mr. Kirwan, it yields by analysis 37 siliceous, 22 argillaceous, 0,2 calcareous, 16 magnesia, and 23 iron.

Another kind of gold colour is found in a green kind of serpentine, in a forest on Harzeburg.

SPEC. XII.

THUMERSTONE, PURPLE BROWN SHORL. Fr. *Shorl Violet*, from Thum in Saxony; also from Dauphiné, and in the Pyrenean mountains.

It is called by La Metherie, *Yanolite*, Syst. Nat. L. ed. Gm. *Shorlus vitreus*—was discovered by Mr. Desfontaine.

It has a perfect vitreous appearance, is in a more or less degree transparent; is generally found in flat rhomboidal crystals, with the two opposite edges a little truncated; the surfaces of the sides are streaked, and the surface of truncation perfectly smooth

smooth and strong shining. It is so hard as to cut glass; strikes fire with steel.

It yields by analysis, according to Klaproth, 55 siliceous, 25 argillaceous, 0,9 calcareous earth, and 0,9 iron, 0,01, manganese.

Another similar kind is found in lamellated embodied crystals, containing no manganese, less shining and less transparent than the before mentioned. This kind Mr. La Metherie mentions in his treatise to be the thumerstone of Werner.

S P E C. XIII.

QUARTZ in GENERAL.

QUARTZ. Lat. *Quarzum*.

This substance is so called in most languages. It is well known, and very common in Europe. It is distinguished by the following properties.

1. It exhibits a vitreous appearance.
2. It is generally found full of cracks, which dispose it to break into irregularly shaped pieces; when exposed to a red heat it cracks still more.
3. It does not melt *per se* when pure, nor does it lose its weight or hardness in fire.
4. It is not affected by common air; is soluble in fluoric, but not in nitric or muriatic acid.

5. It strikes fire with steel.

G 4

6. When

6. When melted with pot-ashes, in a due proportion, it gives a more solid and fixed glass than any of the foregoing siliceous stones; and when melted with three parts of pot-ash, it forms a glass, which attracts moisture from the atmosphere, and becomes gradually a transparent liquor, called *Liquor Silicus*.

It is found in solid masses exhibiting no particular shape. It is also interspersed through other stones, in the state of irregularly shaped pieces, of various sizes, as in granite, of which it forms an essential constituent part.

It is also found particularly shaped, and likewise crystallized, or of regular shape; is of different degrees of purity and transparency, and of a peculiar colour. It seldom forms large veins, and very rarely whole rocks in a separate state.

It is in general the purest of the siliceous stones, though not quite free from a slight mixture of other earths. The most obvious distinction among them arises from their different degrees of transparency, opacity, and colour.

It is a very useful mineral product for the glass manufactory, and particularly so when pure. When mixed with pot-ash and oxyd of lead, it makes flint glass; and when very pure, as in the crystallized state, it serves for optical purposes.

For

For both purposes, Switzerland, particularly the mountain St. Godhard, affords the greatest quantities: pieces are there found from 5 to 800 pounds weight.

At Madagascar crystals were found of six feet long and four wide, and at Fashbach in the Valais, a piece was found of 1200 pounds weight.

Different States of Quartz.

QUARTZ in general may be divided,

1. Into such as is found crystallized, transparent, and very pure, either colourless or a little coloured, called Rock Crystals.

2. Into such as is less pure, less transparent, found either in masses or crystallized, colourless or coloured, called Pure Quartz.

3. Exhibiting a peculiar colour, called Amethyst.

VAR. I. ROCK-CRYSTAL; by the Germans *Bergkrystal*.

French, *Crystal de Roche*.

LINN. *Crystallus Montana*.

WALLER. *Crystallus Montana hexagona*.

CRONSTEDT, *Quarzum Crystallisatum*.

This is the purest kind of all quartz. It contains the smallest portion of other substances, and does not lose its transparency in fire like other quartz.

When

When of regular figure it exhibits a dodecagon or six-sided prisms, terminating in six-sided pyramids, the faces of which proceed from the sides of the prisms. The prisms are transversely striated, but the faces of acumination are smooth.

It is seldom found in masses, but often exhibits various modifications of its primitive figure; is partly colourless, sometimes exhibiting various colours, sometimes coated with pyrites, quartz, sand, &c.

Its spec. gr. is generally = 2,653.

Varieties of Crystallization.

Rock-crystal is found, 1. in long and short prisms, with pyramids either on one, or on both ends.

2. In pyramids without prisms.

The pyramids are either simple or double.

The faces of acumination are either regular, or they exhibit various forms; and the faces of acumination proceed sometimes from the side edges.

Colour, arising from metallic substances.

- | | |
|---|--------------------|
| <i>a.</i> Bright amber yellow, | } from
Bohemia. |
| <i>b.</i> Chocolate brown, | |
| <i>c.</i> Greyish and yellowish white, | |
| <i>d.</i> Brown, from Siberia. | |
| <i>e.</i> Perfectly colourless, from Prieborn, Silesia, &c. | |

Figure

Figure in particular.

(A.) PRISMATIC.

a. In prisms with pyramids on one end, from Vogtland, Ehrenfriedersdorf, Switzerland, Bohemia, Freiberg, Schneeberg, canton Bern. Of this kind are found also two crystals, joined by their side faces in various directions, sometimes the basis of one is placed on the side of the other.

b. In prisms terminating on both ends in pyramids, from Vogtland, &c.

c. In short prisms, with pyramids on both ends, from Marmorosa and Upper Hungary.

(B.) PYRAMIDICAL.

In small double pyramids, seldom three-sided, with an alternation of small and large faces exhibiting pentagons, such as are found at Prieborn, Silesia, &c.

a. In six-sided pyramids, with double acumination—from Silesia.

b. In six-sided pyramids, with unequal faces—from Silesia, &c.

c. The same, but terminating in small two and three-sided pyramids.

d. The same, with the edges a little truncated.

e. In

c. In six-sided pyramids, terminating in three-sided pyramids, proceeding from the alternate side faces or edges.

Crystals of a Second Formation.

Original crystals coated over with additional quartz, or other substances, as the pyramidical quartz, coated with a cornelian coloured substance, from Ehrenfriedersdorf, &c.

Crystals containing heterogeneous Substances included.

Arsenical pyrites, and calcareous spar, from Ehrenfriedersdorf.

White amianth.

Mica, from the same place.

Fluor and steatite.

Chlorit and needle-shaped manganese.

Green shorl, heavy spar, specular iron-stone, martial æthiops, copper pyrites—most of them found in Dauphiny.

VAR. 2. PURE QUARTZ. Lat. *Quarzum purum*.

(A) This kind of quartz is not so pure as the foregoing, is less transparent, and more brittle, and becomes perfectly opaque in fire. It is found in the state of *solid masses*, or pieces, with a glossy surface, exhibiting no particular shape.

Semi-transparent, and colourless,

In this state it is found in copper mines, in the north part of Norway and Siberia.

Semi-

Semi-transparent at Ehrenfriedersdorf, and in a less degree in Bohemia.

Variety of TEXTURE.

- a. Granular.* 1. White—in the gold mines at Adelsfors, in the province of Sudermania, &c.
2. Pale green—in the same place.
b. Sparry. Very scarce.
1. Whitish yellow—in the gold mines in Hungary.
2. White—in the island of Utto.
c. Lamellated. White, yellow and blue—in the gold mines in Hungary.
d. In Grains. As fine white sand—from Schneeberg.

Var. of COLOUR.

- a. White.* — From Freiberg, Gersdorf, &c.
Greyish white, from Freiberg, &c.
b. Grey. Deep smoky grey, at Schneeberg.
Also bluish grey, pearl grey, near Freiberg and Schneeberg.
c. Yellow. Honey-coloured—from the Harz.
d. Red. 1. Blood red—from Spain.
2. Flesh-colour—from Schneeberg.
3. Crimson—from Saxony.
4. Violet—from the island of Utto.
5. Amethyst with white quartz—from Heidelberg.

e. Blue.

- e. Blue.* From the island of Utto, in the province of Smoland.
- f. Green.* 1. Olivegreen—from Johannegeorgensstadt.
2. Pale green—from Adelfors.

(B.) PARTICULAR SHAPES.

- a. Nodular.* Yellowish white—from a sand mine near Leipfic.
- b. Stalactitical*—from Breibach on the Hackenberg, in the bishopric of Cologne, from Iceland, and Ufbanga in Hungary.
- c. Reniform*—from Isaac near Frieberg.
- d. Cellular*—from Peresowikoy near Catharienburg in Siberia, and at Schneeberg.
- e. Cylindrical*—from Hungary near Schemnitz, and at Freiberg.

(C.) OF REGULAR SHAPE, OF CRYSTALLIZED QUARTZ.

Lat. *Quarzum crystallisatum.*

In this state it is found of various degrees of transparency, till to opaque.

As to Figure.

- a. Prismatic*, with pyramids generally six-sided, with regular and irregular shaped faces.
- b. In pyramids without prisms.*

The

The pyramidical crystals are found simple and double, and also in the state of groups or druse, seldom in single crystals.

The crystals are also found of various colours.

- a. Pearl grey, in Hungary.
- b. Smoak grey, } at Schneeberg, and near
- c. Honey yellow, } Bristol.
- d. Reddish, at Gerstorf, Westmania, Bohemia and Silesia, and Oran in the Barbary.
- e. Deep greenish grey, near Freiberg.
- f. Black, in the Palatinate.
- g. Deep blood red, at Schneeberg.
- h. Crimson, in Saxony.
- i. Green, in Dauphiny and Saxony.
- k. Blue, called *false saphir*, in Bohemia, Silesia, and France.
- l. Rose colour, in Hungary and Bohemia.

(C.) OF SELDOM FIGURES.

- a. Cubical figure, sometimes with pyramids, at Schneeberg.
- b. Rhomboidal figure, with the edges truncated, in the valley *Bijoux*, near *Ghent*.
- c. In rhomboidal four-sided plates, partly acuminate, sometimes with impressions, near Freiberg.

VAR.

VAR. 3. AMETHYST, OR AMETHYST-COLOURED
QUARTZ.

Lat. *Amethystus*.

This kind, belonging to the siliceous stones, exhibits a peculiar colour, is found in solid masses of various texture, as conchoidal, fibrous, shelly, granulated, &c. and of various degrees of transparency; has various shades of colour, and is found crystallized.

Is found particularly fine in Mexico, Sweden, Bohemia, and Saxony.

The amethyst from Saxony has yielded by analysis 30 parts of siliceous, 60 argillaceous, 8,22 calcareous earth, and 1,66 iron.

(A.) IN MASSES, PARTLY SOLID, PARTLY IN
LAYERS.

a. Transparent, inclining to opaque, from Deuxpont; generally found with common quartz or calcedony.

b. Shades of colour.

1. Whitish, from Wiesenbach.

2. Greenish white, from Saxony.

Places where particular kinds are found.

a. Fibrous, at Wiesenbad.

b. Conchoidal, at the same place.

c. Granulated,

c. Granulated, bar-shaped, near Freiberg, in the Palatinate, Deuxpont and Schneeberg.

In grains at Heidelberg.

(B.) THAT OF REGULAR SHAPE, OR CRYSTALLIZED, IS FOUND,

a. In simple perfect six-sided pyramidical crystals, at Deuxpont.

b. With faces of different sizes, at Drehbach near Ehrenfriedersdorf.

The crystals are sometimes found adhering to each other.

The amethyst is found in decomposed gneiss, calcedony, flint, &c.

VAR. 4. PRASE.

Prase seems to have its name from the Greek word *πρασον*, which signifies blueish green.

VALERIUS, *Achates pellucida nebulosa viridescens.*

CRONSTEDT, *Smaragd matt.*

This stone may also be considered as a variety of the coloured quartz. It is distinguished by its colour, which is either deep leek green, seldom grass green, or olive green; when broken it is shining, and of a shivery texture, generally semi-transparent, and hard; it is found in simple six-sided pyramids, seldom in six-sided prisms, acu-

H

minated

minated by six faces; very scarce, in small six-sided plates; it contains siliceous, argillaceous, magnesian earth, and iron.

It is found near Kofemitz in Silesia, in Dauphiné, in Bohemia near Breitenbrunnen, in Saxony near Chamouni, and in the environs of Schwarzbach, in large layers containing ores. The layers are composed of magnetic iron pyrites, galena, blend, quartz, and common green radiated shorl. It seems to have its colour of the latter, with which it is found mixed. This substance has by some authors been considered as a variety of the crysolite.

SPEC. XIV.

FLINT. *Silex pyromachus*.

French. *Pierre à feu*. Germ. *Feuerstein* (so called because it is generally used for striking light). Ital. *Pietra focaya*.

It is found in masses of various sizes, chiefly and almost only in Flötz mountains, which are either of a peculiar nature, or in such strata as are composed of chalk or lime-stone—less frequently in primitive mountains—on flat land it was once found crystallized, by Mr. Voyt of Weimar, in a place near *Johanngeorgenstadt*.

It contains frequently petrifications, particularly of the crustaceous, and the small coralline, genus;

+

it

it is also found bearing impressions of *echenits* and *belemnits*, &c.

It is generally found of a yellowish smoke grey, or black grey colour, seldom of other colours.

a. Pale yellowish white—from *Upper Lusatia*.

b. Amber colour—from *Lithuania*.

c. Reddish grey with white spots—from *Johanngeorgenstadt*.

d. Deep oker yellow, with circles of a black kind—in *England*.

e. Greyish black in pudding stones—in *England*, and deep black on the *English coasts*.

f. Yellowish and greenish grey spotted—also in *England*.

It is found solid, interspersed, in angular pieces; in grains, in nodules and globular perforated lumps, almond-shaped, seldom needle-shaped; also in pebbles, very seldom crystallized, in flat double three-sided pyramids, the sides of one proceeding from the edges of the other.

Its surface is generally little shining; when broken it exhibits a conchoidal surface, and the fragments are sharp edged, but of an indeterminate shape; semi-transparent in different degrees; harder than the common quartz; and cannot be scraped with a hard knife.

Its spec. gr. = 2,594.

It strikes fire with steel.

When exposed to a strong heat, it cracks, loses its colour, and becomes more opaque. Its

colour probably arises from ferruginous earth, or other substances containing oxyd of metals. It decays not so easily in air as the jasper, but sooner than quartz, and when decayed it exhibits a chalky appearance; by exposing it to a strong heat, it melts at last into a blackish vitreous substance; it makes glass when melted with pot-ash, but seems not to be so good for that purpose as the quartz.

It takes a high polish, and is therefore used for making buttons, small boxes, mounting canes, sticks, &c. In England it is also used for certain mixtures of glass and earthenware. When reduced to a fine powder, it is excellent for glass-grinding.

It is more transparent than the jasper. It often shows evident marks of having been originally in a soft slimy and tough state, like glue.

According to Wiegeleb some kinds yield by analysis 80 siliceous, 18 argillaceous, 2 calcareous earth.

To the flint belong also those mixed stones called pudding-stones, which are frequently found in England: they consist generally of roundish variously coloured flint pebbles, from the size of a hazel-nut down to the size of hemp-seed, which are conglomerated by a mixture of quartz, hornstone, or jasper; these stones take also a high polish, and exhibit often a beautiful appearance, and are therefore used for boxes, &c.

With

With regard to the formation and composition of flint, mineralogists have suggested various opinions. Mr. *Werner* says, it consists particularly of siliceous earth, crystallizing water, a small quantity of calcareous earth, and inflammable matter. Others believe it to be composed of siliceous, argillaceous, and occasionally a little calcareous earth.

Flint is found in the sea, as well as on land, containing various shells, corals, and sea worms, attached to the surface, but more frequent in Flötz mountains, in chalk and limestone; sometimes in coal strata, as near *Wettin*; in alum rocks, near *Freienwalde*: when found perforated, it has been noted to arise from a decomposition of corals, and other parts of sea animals.

Peirecius has observed, as *Valerius* mentions, that the pebbles and flint have been formed in sea water, from a mixed mass of a slimy consistence, which had become hard by the exclusion of the water. It has also been observed, that flint had its origin from the calcareous substance, of which the shells and corals mostly consist, and the gelatinous and other parts of animals in a state not quite destroyed; but nothing has yet been decided on this subject.

SPEC. XV.

CHERT. *Petro Silex.*

Lat. *Lapis corneus.*

H 3

Ital.

Ital. *Pietra cornia*.

French. *Pierre de corne*.

Swed. *Haella flinta*.

Germ. *Hornstein* (resembling horn).

La Metherie has arranged it with the shörls and hornblende.

The chert is generally found in masses, perhaps never crystallized, except in Saxony, in the mine called Wolfgangermaassen; it is generally found inclining to opaque, or in a less degree semi-transparent than the flint, but more transparent than the jasper, which is hardly ever found semi-transparent in any degree. When broken, it discovers a shivery and conchoidal texture, and has then the appearance of a piece of wax, the colour excepted; it exhibits a coarser texture than the flint.

Its spec. gr. = 2,708.

It is a little acted upon by acids.

By breathing on it, it discovers an earthy smell; strikes now and then fire with steel; can be easily scratched with a hard knife; does not take a high polish like flint; it decomposes sooner than flint, when exposed to air; it melts by itself without ebullition; it melts with soda with effervescence, but is not quite soluble in it; it also melts with borax and microcosmic salts.

It yields by analysis 72 siliceous, 24 argillaceous, and 6 of calcareous earth.

As

As to Colour, it is found,

Yellowish white—from *Johanngeorgenstadt*.

Blueish—from *Schneeberg*.

Pearl green, inclining to red—from *Saalberg* in *Switzerland*, and also in *Saxony*, &c.

Reddish grey—from *Orenburg*.

Reddish brown—from *Schneeberg*.

Carnation and rose colour—from the same place.

Pale green—from *Orenburg*, *Gersebach* near *Meissen*, and near *Freiberg*; also from *Prestgrufvan* and *Hellefors* in *Westmanland*.

Deep mountain green—from *Tyrol*, *Garpenberg* in *Switzerland*.

Smoke grey—near *Freiberg*, &c.

Blackish grey—from *Lorenzgegentrun*, near *Freiberg*.

Deep blackish brown—from *Schneeberg*.

It is found in the Ganges of primitive mountains, also in Flötz mountains. It forms veins and beds of mountains, but never whole mountains. It is also frequently found in nodules like kernels in rocks; whereas the jasper constitutes often the chief substance of the highest and most extended chain of mountains.

The chert is likewise found in great quantity in the neighbourhood of scaly lime-stone, like flint, in strata of chalk; whereas the flint and agates are generally found in loose and single irregular nodules.

As to its use, it is employed in the manufactory of common glass and stone ware.

SPEC. XVI.

CALCEDONY, WHITE AGATH. *Calcedonius.*

WALLERIUS, *Agates, &c.*

CALCEDONY, so called from Calcedon, the name of a place.

This substance is generally found in solid masses of a globular, kidney-like, or stalactitical figure, or in the state of pebbles.

Those which are reniform are often found hollow, containing petrified wood, corals, shells, &c.

It is hardly ever found in layers. When broken it exhibits a conchoidal surface, is semi-transparent, strikes fire with steel, and takes a very high polish.

Its spec. gr. is generally $\approx 2,615$.

It is not readily acted upon by acids; when exposed to heat it does not melt *per se*, but loses its colour, and becomes more opaque.

Its general colour is greyish, yellowish, white, or milk-white, but it is seldom found of any other colour.

The calcedony from the East and Ceylon is reckoned the best. It is frequently found in Italy,

Italy, Hungary, Saxony, Silesia, Feroe Islands. Seals and particular vases are made out of it.

By analysis it yields a great portion of siliceous earth, a little calcareous, less argillaceous earth, and a small portion of iron.

The calcedony from the Feroe Islands has yielded by analysis 84 siliceous, and 16 of argillaceous earth.

VAR. I. CALCEDONY. *Calcedonius genuinus*.

WALLERIUS, *Agathes Vix pellucida nebulosa colore griseo mixta*.

This kind is found of various shapes, viz. kidney-shaped, stalactitical, globular, botrioid; also assume the appearance of hollow pebbles, sometimes containing air-bubbles, or drops of water; the latter kind is called in French *Hydrocalcedoine*, and is found on a hill near Vicenza, on the way leading to Madona di Monte Berico. The matrix consists of black volcanic ashes.

Those pebbles, containing drops of water, have been found from the size of a pea to half an inch in diameter.

It is supposed they have been formed from ashes by heat, and that the water had accidentally entered the mass, before it acquired its hardness; they are very scarce.

In the same way zeolites have been found in the mass of calcedony in the Feroe Islands.

Calcedony

Calcedony is also found in the shape of almonds, mixed in trap.

Other specimens exhibit dendritical vegetations, probably originating from a solution of iron, or some other substance, pervading a mass of calcedony. This kind is called *Mocha-stone*, or dendritical agate.

It is brought to Europe from the port of Mocha. Sometimes the calcedony is found coating other substances.

The pure calcedony is found milk white, inclining to blueish, smoke grey, pearl grey, yellowish grey, flesh colour, amber colour, mountain green, grass green, olive green, generally in the Feroe Islands; milk-white with red spots, in *Oberstein*; black in Saxony and *Chemnitz*; brown near the river *Tom* in Siberia; yellow in the same place, and in Ceylon, Hungary, Saxony, &c.

VAR. 2. CACHOLONY, *Calcedonius cacholonius*.

WALLERIUS, *Agathes opalina tenax, fractura inequali*.

This variety has probably its name from the Kalmucki language; it is said that *Cholony* signifies in that language a stone, and *Cach* a stream, near the Kalmucks of Bucharest, in which it was first found.

Mr.

Mr. Pallas derives the word Cacholony from the Mongool language, and says that the best kind is found in the desert of Gobo.

It is of a milk-white colour, more opaque than the common calcedony. It is worked by the Kalmucks, who make idols and domestic vessels of it: it is very hard, and takes a fine polish.

It is also found in the Feroe Isles, where it lies between the strata of semi-transparent calcedony. It is never found in drops or stalactitical, and seems to be a coarser variety of the true calcedony.

VAR. 3. CARNELIAN.

Sarda by the Ancients,

WALLERIUS, *Carneolus*.

GMELIN, *Calcedonius carneolus*.

The name of this stone, report says, was originally derived from its resemblance to flesh.

It is generally found exhibiting various shades of the blood colour, seldom an equal colour. It loses its colour in the fire. It is seldom found semi-transparent, generally inclining to opaque; possesses the same hardness as the calcedony; when broken it exhibits a conchoidal fracture.

Its spec. gr. is generally = 2,630 or 2,700.

It seems to be a kind of calcedony of a reddish colour, but of a finer texture than the calcedony; never contains petrefactions.

It

It is found in solid pieces, like pebbles, seldom kidney-shaped; sometimes in thin layers; the best kind has a deep red colour resembling the garnets; is found in Arabia.

Carnelian is also found near Chemnitz, Zwickau, and Freiberg; and of an inferior quality in Silesia and Bohemia. It is found oftener in the East, viz. Ceylon, Armenia, Palestina, Egypt, also in Siberia.

It is found of various colours;—as, 1. reddish, white, or flesh colour.

2. Yellowish white.

3. Brownish red.

4. Scarlet.

It is said that the ancients improved the beauty of these stones by boiling them in honey. When the carnelian is mixed with onyx it is called fard-onyx; or white agate fard-agate.

SPEC. XVII.

ONYX.

CRONSTEDT. *Onyx Camebujia Memphites.*

GMEL. *Chalcedonius Onyx.*

WALLERIUS, *Achates vix Semipellucida fasciis stratis diverse coloratis ornata.*

In Ital. *Nicolo.*

The ancients called all calcedonies onyxes.

The

The word Onyx is probably derived from the Greek language, and signifies the nail of the finger, which these stones resemble as to their colour.

They were called Memphites from a town called Memphis in Egypt, whence they were brought to us.

By the modern writers the onyx is called Carneus camahuja; in Ital. *camei*.

The old Romans were accustomed to cut figures on the strait-lined onyxes in *alto*, or *basso rilievo*, which they called Camahuja; they are counterfeited, and called *camei*.

The onyx consists of different-coloured veins, which run parallel to each other, sometimes in straight, sometimes in curved, lines.

Those which consist of concentric circles were also called Mephites.

Another kind, polished and cut, is set in rings, and called *Occhi di Gatti*, which, in hardness, lustre, and property, equals the calcedony.

The onyx loses its colour in the fire, and cracks and breaks, if the heat be sudden or violent.

Its spec. gr. is from 2,500 to 2,600.

It is found in irregular shaped pieces, in nests, in layers, and assumes frequently a pebble-like appearance. When the onyx is mixed with other stones, such as jasper, it is called jasp-onyx; and
in

in like manner, when mixed with carnelian or sardoine, is called sard-onyx; when mixed with calcedony, calced-onyx; with agate, agate-onyx.

It is said that this stone is highly esteemed in the eastern countries; and that in China, where it is called *Yow*, nobody but the Emperor has permission to wear it.

As the onyx is found in large pieces, the ancients were accustomed to make out of it various vessels, and figures representing faces, upon which is displayed the natural colour of the veins and hair. And their art, known to modern artists, consisted in the juxtaposition of particularly coloured pieces of onyx, achat, jasper, and calcedony, disposed in such a manner as to produce a perfect likeness of faces and figures; and this deception cannot be discovered, except by putting them into hot water, which dissolves or softens the mastic with which they are cemented.

S P E C. XVIII.

The SARDOINE, so called by the French, is a semi-transparent agath or calcedony of an orange colour, variegated like calcedony; of the same hardness and gravity.

When exposed to fire, it is found to possess the same properties as the agate.

Its

Its colours appear more lively when transversely looked at.

Daubenton distinguishes five varieties :

1. The pale one.
2. Exhibiting red and white veins, so disposed as to appear like teeth.
3. Sard-onyx, which seems to be composed of concentric layers of different colours, with concentric circles.
4. Exhibiting vegetations.
5. Blackish.

SARDONYX. This stone has been variously described.

By some it has been considered as a mixture of calcedony and carnelian; by others, as a mixture of carnelian and onyx; and others hold it to be the transparent orange-coloured agate with variegated surface, resembling the calcedony.

The variously-coloured component parts generally exhibit parallel stripes.

It is sometimes confusedly blended or mixed.

Its specific gravity is generally = 2,630 or 2,700.

It loses its colour in fire.

It generally strikes fire with steel.

The striped kind with red zones may, as well as the onyx, be cut into cameo.

The

The sardonix is found exhibiting dendritical figures, resembling the calcedony or agate, and is also called *Mocha-stone*; but it differs from the real *Mocha-stone* in this, that the stripes are red, whilst those in the calcedony are black.

The onyx and sardonix are imitated by vitreous fluxes, but they are soon discovered by the file and the vitreous appearance.

It seems that the ancients knew how to imitate them, as such stones are found among the pastes of the ancients, which resemble the onyx very much. Steatites or speck-stone is the best substance for this purpose, as it is soft, and becomes very hard when exposed to heat, so as to strike fire with steel, and takes a high polish.

The onyx of a blackish appearance is imitated as Van Boot points out. He directs to take a certain quantity of pulverized sea-shells, such as the Italian ladies use for paint, and to mix it with filtered lemon-juice, in such quantity as to ascend four fingers high above the powder. This mixture is for ten days to be exposed to a gentle heat in a close glass vessel; afterward the liquid is decanted, and the powder well washed, and rubbed with the white of an egg. After which it is easily moulded into various figures.

SPEC.

SPEC. XIX.

CHRY SOP RASE.

GMEL. *Chalcedonius Chrysoprasus*

Germ. Gold—Prafer.

This stone is best ranked amongst the siliceous stones; and may with propriety be placed next to calcedony, which it resembles most.

It exhibits generally an apple-green, grass-green, or greenish white colour. It is found in solid masses, and breaks with an even surface, having a dull appearance. Its fragments have an indeterminate angular figure, mostly sharp-edged. It is generally semi-transparent, but more frequently inclining to opaque; is hard, but does not strike fire with steel. It has its colour from oxyd of nickel, and yields on analysis 69,16 siliceous, 0,08 argillaceous, 0,82 calcareous earth, 0,08 iron, and 1 nickel.

The finest kind is found near Kossemütz, in the principality of Münsterberg, in Lower Silesia. It is generally found loose, in pebbles, on the Altenberg, near Hachlau; in the environs of Olp, near Turnau; and in the Mummel Grund, on the banks of the Iser, in Bohemia, near Münsterberg. It is found with opal horn-stone, in layers of asbest, talc, lithomarge, and iron ochre.

SPEC. XX.

AVANTURIN.

This stone is also with much propriety ranked among the siliceous mixed stones. It is said to owe its name to the resemblance it bears to a glass flux, called by the Italians *avanturino*, which was first prepared at Moreno, near Venice, and, as report says, accidentally discovered, while experiments were making on glass fluxes, by a small portion of gold falling into a mixture of this kind, which on cooling exhibited so beautiful a colour, that after further experiments by which it was improved, it was esteemed of sufficient value to be set in rings, and fashioned into small boxes.

The true, or at least that kind of stone which was called the natural *avanturine*, seldom exhibits so fine an appearance as the artificial, and is besides scarce. A very fine large specimen may be seen in the Leverian Museum, which was found in the ruins of the triumphal arch of Julius Cæsar, in the valley of Susse in Piedmont, in 1788, by the Sieur Francis Ludwig, of Mayence, in Germany.

The stones called *avanturines*, are composed of different substances, but are generally siliceous, when they strike fire with steel. They take a fine polish, and are not readily acted upon by any acid, except the fluoric. A few varieties contain calcareous

calcareous earth, and those effervesce weakly with acids.

Some have ranked the avanturines among the opals. Romè de Lisle, who gives the best account of the avanturine, says it is produced by an intimate mixture or aggregation of quartzose grains, differently coloured, and disposed in such a manner as by the reflection of the light to exhibit an appearance as if gold dust were mixed with it.

But stones are found, called avanturines, which certainly contain gold-like pyrites, micaceous iron-stone, and common pyrites. Some of these resemble quartz, some feldspar, others jasper, &c. They are found of various colours :

1. Of a deep colour, semi-transparent, exhibiting shining lamellæ of a gold colour, and in the form of roundish pebbles, at *Arragonia* in Spain, where this kind is called the red avanturine.

2. Found with shining lamellæ of a silver-white colour, called the grey avanturine.

3. Of a yellow colour.

4. Of a blackish colour, semi-transparent, the lamellæ of a silver-white colour, called the black, or Oriental avanturine.

5. The same kind, but the lamellæ exhibit a golden colour, at *Facehaj*, in Transylvania.

6. Composed of deep grey quartz, containing iron pyrites, in a stellated position, in Saxony.

I 2

7. Brown

7. Brown and yellowish-red coloured siliceous particles, mixed with clay, containing a little gold and silver, like pyrites, in Spain.

8. Rhomboidal feldspar, of a brown and rose colour, found in granit.

9. Siliceous pebble, in iron-stone resembling marshy iron ore, in Bretagne.

10. Yellowish quartz with gold-coloured mica interspersed.

11. White shining marble containing mica.

12. Rhomboidal calcareous spar, containing pyrites. They are imitated by immersing red-hot quartz in cold water, when the cracks exhibit an appearance resembling the avanturine.

SPEC. XXI.

HELIOTROP. *Blood-Stone. Silex Heliotropius.*

GMEL. *Chalcedonius Heliotropius.*

WALLERIUS, *Jaspis variegata obscure viridis, punctis rubris.*

This stone is generally of a leek-green colour, with blood red spots or veins. It is said to be so called because when it is put into water it reflects the rays of the sun red, and when out of water it was said to exhibit the figure of the sun and moon.

Certain

Certain authors have described it as a green jasper with red spots ; but Mr. Werner considers it as a peculiar species, because it is semi-transparent, and exhibits a conchoidal surface when broken.

Its spec. gr. = 2,633.

It is found particularly fine in the East and Egypt.

La Metherie arranges it with the agates.

AGATE, or ACHATES.

This substance cannot properly be considered as a peculiar species, as it is merely an imperfect mixture of different stones. It is said that it has its name from the river *Achates*, in Sicily, where it was found by the ancients.

As to its general appearance, it approaches nearest to the calcedony ; is generally semi-transparent, and is never found crystallised, owing perhaps to the admixture of argillaceous earth ; but it sometimes contains the rock-crystals in a crystallised state.

It is generally composed of several of the following substances, as quartz, rock-crystal, hornstone, flint, amethyst, jasper, indurated lithomarge, and heliotrop.

Calcedony seems to be its principal basis. From the various substances of which it is com-

posed, arise its various colours, and also its different degrees of transparency or opacity.

On account of the different disposition of the component parts and figures which it exhibits, it has obtained different names, so is its transparent part owing to the rock crystals or quartz; the milk-white colour from calcedony; the smoke grey from flint; the yellowish grey from yellow flint and jasper; the blood red from red jasper; purple from amethyst; and the green from heliotrop.

The agate is generally found in the state of hefts, pebbles kidney-shaped, hardly ever in layers; never forming whole rocks, as the jasper. It contains a greater portion of siliceous earth than the jasper; is generally so hard as to strike fire with steel.

From some observations it has appeared, that the mixture of the agate mass has been in a liquid state, and has so entered the cavities of certain stones; as the apertures are generally found very obvious, and that when the liquid mass has been a mixture of different substances, the agate formed from it of course exhibits various colours; and when the different component parts have entered separately or successively into the cavities, the agate exhibits then zones of different colour and appearance, and more or less transparent or opaque. When the component

component parts run parallel through its matrix, the agate is then called ribband-agate. When the component parts have formed arborisations, it has been called *arborised agate* or *mocca stone*.

The agates are also by some authors denominated according to their predominating component parts; so it is called, 1stly. *calcedonous agate*, when the calcedony predominates; or 2dly, *sardon-agate*, if the cornelian predominates; 3dly. *jasper-agate*, when the jasper prevails; and 4thly. *amethyst-agate*, when the amethyst prevails.

Some mineralogists arrange the Egyptian pebbles with the agate.

A semi-transparent kind with red spots is called *gemma divi stephani*. Some kinds display the colours of the rainbow.

The following varieties are generally noticed.

1. Fortification agate.
2. Landscape agate.
3. Moss agate.
4. Agate spotted, resembling stars.
5. Ribbon agate.
6. Tubulous agate.
7. Variegated-agate, exhibiting circular zones.

In commerce, those which are the most perfect are called Oriental agates, and the others Occidental.

Germany produces undoubtedly the greatest quantity, and also the best kind of agates; they are found particularly in the Lower Palatinate, near Alzey, Flonheim, Ufhoven, and Oberstein; in Deuxponts, near Utzenbach, Grünbach, &c.; in Saxony, at Kunnerdorf, Schlottwitz, Verzenstein; at Hallsbach, near Freiberg; at Rothlof, near Chemnitz; at Wiederau, near Rochlitz, in Bohemia and Silesia.

SPEC. XXII.

JASPER, JASPIS.

WALLER. *Petro silix jaspideus.*

Ital. *Diaspro.*

The jasper is a stone approaching more to the nature of siliceous than to that of the argillaceous stones, amongst which it has been ranked by Mr. Werner.

It is found in veins and beds in mountains, forming the matrix of porphyry; sometimes it forms whole parts of rocks.

It is the only kind of stones that is found of all varieties of colour, and is found almost in all countries.

It

It has an appearance as if it originated from indurated bole, flint, and calcareous earth, combined with an unknown menstruum.

It is never found crystallized; it breaks into pieces of indeterminate shape, takes a good polish, and is more easily affected by air than quartz.

Its red colour becomes deeper in the fire, but it does not melt *per se*.

Its surface sometimes denotes the flint, and, when fresh broken, it is conchoidal, resembling much an indurated clay; certain kinds have an earthy dull appearance, and a fine texture. The jasper is not so hard as quartz; some kind strike fire with steel.

As it is not readily acted upon by acids, heat and long digestion with the vitriolic acid, are required, in order to extract the argillaceous earth and iron, with which it forms alum and martial vitriol.

By the application of heat it is not rendered quite soluble in soda, but it effervesces, and divides into fine particles.

It melts with borax and microcosmic salt, without effervescence; it does not become electric, nor does it crackle in the fire or lose its colour.

Its spec. gr. is = 2,600, or 2,700.

It is composed of siliceous argillaceous earth, and a considerable portion of iron.

The

The jaspers are generally arranged or divided according to the different colour they exhibit.

Mr. Daubenton has mentioned the following 15 varieties, viz.

1. The *green* kind, from Bohemia, Silesia, Siberia, and the shores of the Caspian Sea.

2. The *red*, or the *diaspro rosso* of the Italians, which is not so common, nor in such great masses as the green.

3. The *yellow*, from Freiberg and Rochlitz. It is sometimes of a citron colour, looks as if composed of silky filaments, and is called the silk jasper.

4. *Brown*, from Dalecarlia, in Sweden; also from Finland.

5. The *violet*, from Siberia.

6. The *black*, from Sweden, Saxony, and Finland. This is the *paragone antico* of the Italians.

7. The *blueish grey*, which is very rare.

8. The *milky white*, of which Pliny speaks. It is found in Dalecarlia.

9. The *variegated*, with green, red, and yellow clouds.

10. The *blood-stone*, which is green, with red specks, from Egypt, and was supposed to stop bleedings.

11. The *veined*, with various colours, which, when it resembles letters, is called *jaspe grammatique*

matique by the French. Some of this kind are found near Rochelle, in France, and called *polygrammatogues* by those who prize trifling accidental qualities.

12. That which has various coloured zones.

13. That called *fionto* by the Italians, which displays various colours, without any regular order.

14. When the jasper has a great number of colours together, it is then called *universal*.

15. When the jasper is found to contain agate, it is called *agatified jasper*.

Cronstedt divides the jasper into

1. The pure jasper of various colour.

2. Jasper containing iron, *jaspis martialis sinople*.

This kind contains 18 or 20 per cent. of iron.

(A) Coarse grained.

A red and reddish brown sinople, from the Hungarian gold mines, near Chimnitz; it forms considerable veins. It has frequently specks of marcasite; contains cubic lead ore and blend, and the gold it contains more than compensates the labour of working it; there is likewise a striped sinople of various colours.

(B) Steel grained or fine grained.

A reddish brown, from Altenberg, in Saxony, looks like the red ochre or chalk used for drawing, and has partitions for veins, which are unctuous to the touch like serpentine.

(C) Of

(C) Of a close and shining texture like a flag.

a. Liver coloured.

b. Deep red, in the province of Wermeland, and at Sponwyit, in Norway.

c. Yellow, from Bohemia.

Werner arranges the jasper with the argillaceous stones; he mentions particularly four kinds.

VAR. I. EGYPTIAN PEBBLE.

French. *Caillou d'Egypte.*

Germ. *Egyptenstein.*

GMEL. *Jaspiæ Egyptia.*

This stone differs a little from the real jasper, and would be better separated from the other real jaspers.

It has the appearance of being formed by coagulation.

It is found in oval longish flattened pebbles, outwardly of a liver brown colour, toward the interior part inclining to yellowish cream colour and yellowish grey, mostly with concentrical stripes or dentritical figures, called by the French *Caillou herborisé*.

Its spec. gr. = 2,564.

When broken, it exhibits a glittering mostly dull conchoidal surface; its fragments are irregularly angular, opaque, and hard, and take a fine polish.

It is made into variously shaped vessels.

It

It is found on the shores of the Nile, near Cairo, in Upper Egypt; also in Arabia, at Freifen, in Lothringen.

VAR. 2. RIBBAND JASPER.

GMEL. *Jaspis fasciata*.

WALLER. *Jaspis variegata fasciata*.

This kind exhibits always different colours, mostly in straight parallel, but seldom in curved lines or layers.

The most general colours are,

The yellowish grey, brownish red, seldom mountain green, red, and lavender blue.

It is found solid in long layers; when broken it exhibits a dull somewhat conchoidal surface, is sometimes semi-transparent on the edge, and takes a high polish.

It is found in Siberia, in Saxony, near Gnadstn and Wolfnitz, but particularly fine at Ural.

VAR. 3. PORCELANE JASPER.

GMEL. *Jaspis porcelanea*.

This kind is of a pearl grey or lavender blue colour. It is found in compact layers, frequently between the fissures of basaltes. It is distinguished by its arid appearance, and by its cracks or flits. Its surface, when newly broken, is a little shining
and

and gibbous. The fragments are of an irregular shape, sharp edged, not brittle but hard.

It is very frequently found in Bohemian mountains, near Strake, Schwintschiz, Lessa, &c.

VAR. 4. COMMON JASPER.

GMEL. *Jaspis vulgaris*.

CRONSTEDT. *Jaspis*.

WALLER. *Jaspis particulis subtilissimis unicoloris, &c.*

This kind is found of a yellowish white, blueish grey, or ochre yellow colour. It is most generally of a yellowish and liver-brown blood and cochineal red colour, though sometimes it exhibits many colours.

It is found compact, sometimes coarsely interspersed with other stones in alternate layers, and is often seen in obtuse angular pieces. When broken it exhibits a faintly shining surface, more or less gibbous and opaque.

It is found in various places in Germany; in Saxony, between Altenberg and Geising, near Freiberg, Johannegeorgenstadt; in Silesia, near Turnau; Schemnitz, in Hungary, &c. also in the Eastern countries.

Sometimes jasper contains petrified wood (called wood-stone by Werner) exhibiting various colours. The apple green is found particularly fine near Coburg.

The

The black jasper is also particularly fine, and to this probably belongs the basaltes of the ancients, or lapis Æthiopicus.

The sinople is a brown red ferruginous jasper, called by Born, ferrum jaspideum.

There is another kind, which is composed of cinnabar and quartz, found at Mörsfeld in the Palatinate, and Tuscany.

The green jasper with red speck is found at Kuttenberg in Bohemia.

Some kinds of jasper contain animal petrifications, viz.

1. The red and brown jasper with trochits, found near Potsdam.
2. The sinople, containing madrepors, near Schemnitz.

SPEC. XXIII.

SILICEOUS SHISTUS.

Germ. *Gemeiner Kiefelschiefer.*

French, *Petrofilex schisteux.*

GMEL. *Lydius siliceus.*

This stone is of a smoke deep blackish green, and blackish colour, often containing veins of grey quartz or blood-red iron-stone. When broken its surface has a dull appearance; has a shivery texture. It breaks in indeterminate shaped pieces,

pieces, semi-transparent on the edges, is so hard as to take a good polish. It yields by analysis 75 siliceous, 4,58 magnesia, 10 calcareous earth, and 3,54 iron.

Is found generally in mountains of argillaceous shistus.

With this may be ranked the Leidisher Stein of Werner, or touchstone; French, *pierre de touche*, lapis Lidicus.

That stone which Mr. Werner has pointed out is of a deep greyish black colour. When broken it has a faintly glittering appearance, a conchoid surface, perfectly opaque.

It yielded by analysis, according to Mr. Wiegleb, 75 parts of siliceous, 4,58 magnesian, 10 calcareous earth, and 3,54 iron.

It is generally found with siliceous shistus.

Almost all stones which are not of a calcareous nature will serve for the same purpose, viz. jasper, petrosilex, argillaceous shistus, basaltes, trapp, &c. &c.

SPEC. XXIV.

OBSIDIAN, ICELAND AGATE.

GMEL. *Lava vitrea*.

WALLER. *Porus igneus lapideus solidus vitreus. Lapis obsideanus.*

This stone is of a greyish, mostly a blackish colour. It is found in irregularly shaped pieces.

Its external surface is ash grey and opaque; when broken, it shews a convex, shining surface.

Its fragments are sharp edged. It is semi-transparent on the edges, and rather light, hard, and electric.

It is found in Iceland, and near Tokay in Upper Hungary, forming the basis of a certain kind of porphyr.

Mr. Werner was the first who shewed that this stone was a peculiar species of stones. Before him it was denominated lava-glass, or agate; in short it was considered to be merely a volcanic production. Mr. Werner has also proved that this mineral is not restricted to Heckla in Iceland, but is also found incorporated with other stones in other parts. Pieces of it are found in Tokay and Madagascar.

Mr. Gerhard found it also in decomposed granite, gneiss, porphyr, &c. in the state of separate pieces, which Mr. Gerhard calls lux-saphyr. From this it is evident that the name lava-glass is improper, and the denomination agate not less so. Besides, it has been proved that this mineral answers to the description of the substance which Pliny calls Obsidian.

S P E C. XXV.

VARIOLIT.

This stone is not much known, and is found only in few parts of Europe.

It is found in roundish masses, in the Durance near Briançon.

Is generally of a blackish green colour, opaque, has a dull appearance when broken; is hard, and takes a greasy polish. It contains small pale mountain green globules intermixed, which give the surface of the stone an appearance somewhat similar to the appearance of many pustules in the small-pox, whence it has the name Variolit. It is composed of siliceous, argillaceous, calcareous earth, and iron.

SPEC. XXVI.

FELDSPAR.

Germ. *Feldspath*. Latin *Feldspathum*.

CRONSTEDT. *Spathum Scintillans, rhombic quartz.*

This stone is composed of shining lamellæ, placed one over the other, often in an irregular manner, but its figure approaches always either to the cubical or rhomboidal.

It breaks also in pieces, which exhibit that figure. It is of a lamellated texture, is softer than the quartz, but it strikes generally fire with steel: it is generally opaque, but also found semi-transparent. Its surface can be scratched with a hard knife. It is decomposed, when long exposed to air and moisture, into white clay or lithomarge. It does not crackle when exposed
to

to a sudden heat; does not become phosphorescent. It melts by a strong heat, without ebullition, and when melted with alkali, it forms a transparent greenish glass. It does not effervesce with acids, and the acids act upon it only when digested with them for some time, and that heat is applied.

Its spec. gr. is generally = 2,500.

It is chiefly composed of siliceous earth, intimately mixed with argillaceous and magnesian earths, and fluoric acids.

The feldspar is one of the principal component parts of the primitive stones or rocks, such as the granit, porphy, serpentine, &c. It is found in solid masses of a particular shape, as in garnits; or in the strata of decomposition, as in sand from decomposed granit; and often found crystallized, and of various colours. Its primitive figure is that of a rhomb, with one angle of 65° , and the other of 115° .

The rhomb exhibits often a four-sided rectangular prism, obliquely truncated on its extremities, with an angle of 60° and 120° . The prism is sometimes found truncated on the angles, which makes it appear a suboctaedron, and the pyramid has various faces; sometimes the prism becomes an hexaedron. Its figure undergoes various other modifications.

It has its name from the German language. *Feld* signifies a field, and also a compartment or regular surface. Thus feldspar is composed of little compartments of rhomboic or other figures, and *spath* is an old miner's word, and is understood to be a semi-transparent stone, of a rhomboidal figure, composed of certain angles, indicating the texture.

It is found of various colours, white, reddish, greenish, yellowish, and blueish.

Mr. Werner mentions four varieties.

VAR. I. COMMON FIELDSPAR.

Germ. *Gemeiner Feldspath*.

Latin. *Feldspatum Vulgare*.

This kind is generally found of a pale colour, as flesh colour, yellowish, grey, whiteish, milk white, but seldom of a vivid green, or blueish colour.

It is found compact, solid, and incorporated with other substances. Its regular shape is that of a four or six-sided rhomboidal prism, with different accuminations, or that of a parallelo-piped, but seldom assumes the form of a rectangular prism, having four, six, and eight sides; very seldom in cubes, in fine semi-transparent needle-shaped crystals, or in six-sided plates.

When broken, the surface is a little shining, has a lamellated texture, the fragments are rhomboidal.

boidal. Is less hard than quartz, but strikes fire with steel. Its spec. gr. = 2,594, and yields generally by analysis 74 parts siliceous, and 24 argillaceous earth. Is frequently found in the mixture of the two primitive mountains, as the granit and gneiss, also in small particles in porphyry. A red kind yielded by analysis 79 siliceous, 16 argillaceous earth, and 2,3 of iron. In the Portsoy-granit at Aberdeenshire, it constitutes the chief component part, in which the feldspar is divided by quartz, in certain directions, and the mica scarcely discovered.

VAR. 2. COMPACT FIELDSPAR.

WERNER, *Argilla Feldspatum solidum*.

Its colour is generally grey green, also blueish. It is found solid and interspersed, has a lamellated texture, breaks in indeterminate acute angular pieces, and is almost semi-transparent. It is found, though rarely, in a mixture of quartz and mica in *Steiermark*. Mr. Magellan has added another variety, which he calls the white feldspar, described by Mr. Bayen, which is found at St. Marie, in the mines in Lorraine. He says it strikes fire with steel, but is more readily acted upon by acids than the other kinds, and is composed of half its weight of siliceous, and the other half of magnesia and iron. Another kind from Alençon contains, besides flint and magnesia,

some calcareous earth, and a greater proportion of iron.

VAR. 3. LABRADOR-STONE.

GMEL. *Feldspatum Variabile*,

CRONSTEDT. Edit. Magell. *Spatum rutilum versicolor*.

This kind of feldspar is generally of a light or deep grey colour, but when held in certain directions to the light, it reflects various colours, as lazuli-blue, grass-green, apple-green, pea-green, seldom a lemon-yellow. Some have an intermediate colour betwixt red copper and tompac grey, and besides other colours between grey and violet. These colours are seen for the most part in spots, but sometimes in stripes on the same piece. It is found of angular form in pretty large pieces, containing occasionally black bar-schorl, mica, and iron pyrites interspersed. When broken, its surface is shining, its texture foliated, and the fragments are rhomboidal. They are semi-transparent, and in other respects agree with the feldspar. It is only 15 or 16 years since this beautiful stone was made known to us. According to Dr. *Brückmann* of Brunswick, it was first discovered by Mr. Wolf, on the Labrador Coast, in North America, where the Moravians have a colony among the Eskimaux. Mr. Wolf discovered this stone accidentally, on the sea shore

under the water, by the variety of colours which it reflected under the water, from the action of the rays of the sun on it.

Mr. Wolf gave it to Bishop Leiriz, who first brought it to Europe.

It is found on the island St. Paul's in the greatest quantity. The Labrador stone is found in layers, and often deposited by the sea on the Labrador Coast.

It contains not unfrequently quartz and micaceous particles, which induced Dr. Brückmann to believe that it entered into the composition of certain kinds of granit.

Mr. Pallas mentions that near Peterfbourg has been found Labrador-stone, containing metallic veins.

Mr. Gerhard has also found some, near Potsdam. It has been found, though very seldom, near Lobau in Upper Lusatia, in Bohemia near Iser, on Ural in Siberia. Mr. Lucar in Halle discovered a Labrador-stone in the street, among plaster-stones on the pavement, which was taken up and examined in the year 1790, and was found to be chiefly granit. Its weight was near 600 pounds; when polished it reflected the light with different colours, which characterises the Labradors. The quartz which it contained was smoke-grey, and the mica partly blackish brown, partly yellowish white. On some places the

K 4

fieldspar

feldspar seemed to predominate, which is of a greyish white colour, with blue shades, has a lamellated texture, and the fragments are rhomboidal.

VAR. 4. MOONSTONE.

GMEL. *Feldspatum lunare*.

Argilla feldspatum lunare, by WERNER.

French. *Pierre de Lune*.

Germ. *Mondstein*.

This stone is generally greyish white, milk white, seldom of a pale flesh colour, having a lustre similar to mother-of-pearls, and is semi-transparent. It is found in obtuse angular pieces, sometimes approaching to cubical, and has a lamellated texture. The fragments are rhomboidal, and in other respects it resembles the common feldspar. It is found in Ceylon.

With this species may be ranked the ADULARIA, which is generally of a white colour, sometimes a little inclining to greenish or yellowish white, of a lamellated texture. The lamellæ of the surface are often so disposed as to reflect the light in various colours. Its lustre resembles often that of mother-of-pearls. It is harder than the common feldspar, and generally semi-transparent. It is found in solid pieces, and also crystallized, of rhomboidal figure, and of irregular, angular, broad six-sided columns,

columns, terminating in pyramids, and in rectangular four-sided plates.

It yielded by analysis 62,43 parts of siliceous, 19,33 of argillaceous, 5,5 magnesia, 10,98 felenite, and 1,75 water.

It is found on St. Gothard, in Switzerland, in Delphinate, Ceylon, and near Leipzig at Altranstaedt.

VAR. 5. CATS EYE.

WALLERIUS. *Achates plus minus, opaca, colores vel lucem diversimode reflectens.*

GMEL. *Feldspatum, Oculus Cati.*

CRONSTEDT. *Pseudo palus.*

Germ. *Ratzen Auge.*

French. *Oeil de Chat.*

The Sun Stone of the Turks.

This stone has also been differently arranged; some have placed it with the opals.

It has its name from its resemblance to cats eyes. Its colour is generally yellowish or greenish, and a glow of light issues from certain points of its surface, in radiations of a yellowish brown colour, somewhat similar to cats eyes. Its texture is so compact, that the lamellæ are hardly discernable. It is so hard as to strike fire with steel; is semi-transparent.

It is found in Ceylon and Siberia.

Its spec. gr. = 2,657.

Dr.

Dr. Brückmann has a specimen of it half an inch in diameter in all directions; and the grand duke of Tuscany has one an inch in diameter.

THE GIRASOL.

This stone is by some mineralogists considered as a kind of cats eye, of a sea colour, reflecting a blue light. This is perhaps what certain mineralogists call the fish-eye stone. The Girasol is generally described to be a milk-blueish semi-transparent stone, which reflects various colours. Its distinguishing character is, its exhibiting a globular or semi-globular pebble, having luminous points, which reflect the light in all directions. It is found in Chypre, Calatie, Hungary, Bohemia, and in the mines of Bretagne. The Girasol is often ranked among the opals, which it resembles much. Professor Blumenbach mentions in his book another variety of feldspar, which he calls Edelspath, *feldspatum gemmeum*. This stone differs from the other feldspar in this, that it is of a higher colour, more transparent, resembling certain gems, is harder, and has a finer texture. It resembles the saphyr-spar or star-saphyr from Ceylon, and the emerald spar from Orenburg.

S P E C.

SPEC. XXVII.

OPAL, OPALUS.

Paedros of the Greeks.

Girasol of the Italian.

Also called *Lapis Elementarius*, from its exhibiting various colours.

The opal has been often ranked among the gems, and by others among the argillaceous stones, though they exhibit more marks of the softer kind of the siliceous stones. It is a hard semi-transparent stone, which reflects the light in various colours, according to the direction in which it is held to the light. Dr. Brückmann, who has given an excellent account of the opals in his book on gems, supposes that the reflection of the various colours arises from the disposition of its texture or cracks, which the best opals always discover. *Delius* attributes the various colours to iron and inflammable substances.

It is generally found of a milk white, blueish white, and greenish colour, seldom reflecting the purple and green colour, and those are of very high value. The opal takes a fine polish, but is not so hard as to strike fire with steel.

It is not fusible *per se*, but becomes quite opaque, and loses its colour in the fire.

Its spec. gr. is = 1,900, sometimes a little more.

It is not readily acted upon by acids, but some kinds of opals were boiled in sulphuric and vitriolic

trilic acid, and produced alum, which accounts for the aluminous earth which it contains, which had not intimately enough combined with the filix, as is observable in the other gems of the siliceous genus.

It has never been found crystallized.

Most of the opals are somewhat hydrophanous, and have small cavities in their texture. The opals appear more beautiful when immersed in water.

When just separated from the matrix, they have generally the appearance of ice, but after they have been exposed to air or heat, they become more opaque, and exhibit also various colours.

According to some analysis, the opals are composed for the most part of siliceous earth, and a little argillaceous earth; some in the following proportion, 86 siliceous, and 14 of argillaceous earth.

Dr. Beireis thinks the opals are volcanic product, or their component parts are combined by means of the subterraneous fire. Its matrix is generally clay, sand, and ferruginous earth.

It is found in different parts of the world, particularly fine in Hungary. The opals were much esteemed by the ancients, and are now so by the Turks, and in the East Indies.

Mr. Werner mentions four varieties.

VAR.

VAR. 1. OPALUS NOBILIS.

The real Opal, or *Opal of many Colours*.

Germ. *Edler Opal*.

WALLERIUS. *Opalus colore olivari, reflexione ruber*.

This kind is generally milkish white, inclining to blueish; when held to the light appears yellowish or reddish; some reflect various other colours, as green, yellow, red, and blueish.

Its spec. gr. is = 2,114, sometimes less.

It is found in solid pieces, sometimes it is found incorporated in other stones. When broken, its surface appears conchoidal, and has a strong lustre. The fragments are semi-transparent, and not very hard.

It is found in the Carpathian mountains, and at Eperies near Ezernizka in Upper Hungary.

VAR. 2. COMMON OPAL, *Opalus Vulgaris*.

WALLERIUS. *Achates fere pellucida colores pro situ spectatoris mutans?*

This kind differs from the foregoing, in not reflecting the light with so beautiful colours.

Its general colour is milk white, seldom with shades of green or flesh colour.

It is found near Radamischel in Poland, near Kosemütz in Silesia; near Johannegeorgenstadt, Eibenstock, where it is occasionally found in granit; in Saxony near Freiberg and Frankfurt.

According

According to Mr. Klaproth, it yields by analysis 98 siliceous, 0,1 argillaceous earth, and 0,1 iron.

VAR. 3. OCULUS MUNDI, *Hydrophan. Lapis mutabilis.*

Germ. *Weltauge.*

GMEL. *Opalus Hydrophanus.*

WALLERIUS. *Achates unguinum colore, in aere opaca, aqua pellucida.*

This stone was formerly of great value, but little known to moderns, before Mr. Boyle did notice it particularly.

It is distinguished from the real opals and other stones in this peculiar property, that it becomes transparent when put into water, and loses its colour or opacity, which it recovers when dry. During the absorption of water it emits a musty smell and air bubbles, so that it becomes evident that this property of becoming transparent in water arises from its porous texture, by means of which it absorbs the water, and dislodges the air contained in the pores. It also absorbs melted wax, and becomes then of course transparent when heated, and is then called *Pyrophan.*

It adheres to the tongue, and is of less specific gravity than the real opal.

It is generally easily acted upon by acids; is not very hard, so that it can be easily cut and polished.

Some

Some kinds, besides being transparent, exhibit various colours, like certain kinds of real opal, as the colour of mother-of-pearls, or other colours; but then they are scarce, and of high value.

The hydrophan becomes also transparent when immersed in vitriolic acid, but it retains its transparency until the acid is taken away by an alkali.

It is generally found to accompany other stones, or in the state of incrustation in contact with opal, calcedony, prasem, chrysoprase, granit, jasper, or indurated clay. Seldom (if at all) exhibiting three-sided pyramids, such is said to have been found on the Ferroe Islands. The hydrophans are generally found near Ezerizka and Lipstop in Hungary, in Silesia near Eibenstock, Schneeberg.

They yield by analysis siliceous, argillaceous earth, and a little iron; some have been found to contain also magnesian earth.

Much pains have been taken in order to discover its nature and formation, but nothing particular has been ascertained respecting it.

Brückmann and Veltheim have given the best accounts of it.

Some mineralogists believe it to originate from the opal having undergone a certain decomposition or change; others consider them as opals that have not attained a perfect state.

VAR. 4. HALB OPAL, by Werner.

GMEL. *Opalus vilior*.

This kind is found of various colours, blueish, pearl, reddish, greenish, yellowish grey, wax and honey colour, flesh and hyacinth red, &c. Sometimes one specimen reflects two colours, such as red and blueish grey.

It is found solid, very seldom incorporated in other stones; when fresh broken, it exhibits in a greater or less degree a shining surface; sometimes it has a waxy, sometimes a vitreous lustre. The texture is conchoidal, the fragments are sharp edges, are more or less semi-transparent on the edges, brittle, and not very hard.

It is found in Hungary, in Iceland near Cosmütz, in Silesia, in Bohemia near Freiberg, at Johannegeorgenstadt, &c.

Karsten (*Museum Leskianum*) mentions three instances of the change of this opal into substances of a different appearance, namely, the halb opal changing into hornstone, porcelain earth, and into jasper. By the first process it loses its hardness and lustre. Its texture appears shivery; and by the second change it loses all transparency, hardness, and gradually takes an earthy appearance, and adheres to the tongue.

VAR.

VAR. 5. WOOD OPAL.

Germ. *Holz Opal.*

GMEL. *Opalus Ligneus.*

This kind, resembling petrified wood, is of a milk, reddish and yellowish white, hair and chocolate brown, or hyacinth colour; generally one specimen exhibits various colours.

It is found in solid masses, sometimes mixed with wax opal, has a shining surface, generally semi-transparent on the edges. Its texture is rather shivery or fibrous, sometimes conchoidal, but always conchoid when transversely broken.

It is found in Hungary near Chemnitz.

SPEC. XXVIII.

PITCH-STONE.

Germ. *Pechstein.*

French. *Pierre de poix.*

GMEL. *Opalus piceus.*

This stone, which was first mentioned by Schulze, has its name from the German word *pech*, which signifies pitch, Lat. *pix*, to which it has great resemblance.

Its nature is not yet well ascertained.

Romè de Lisle ranks this stone amongst the volcanic products; and Mr. Kirwan particularly among the lava, because it was often found in volcanic countries; but this is no proof, as it is also

L

found

found in the Pyrenees, where no traces of volcanoes have been discovered.

The pitch-stone is found at Mefnil Montant, near Paris, in beds; frequently in Bohemia, Silesia, Hungary, Siebenbürgen, Frankfurth on the Mayn.

In Saxony the pitch-stone forms whole masses, and makes the basis of certain kinds of porphyr.

It is else found in layers of a globular or stalactitical form, and is sometimes crystallized.

The common kind is of a brown colour, melts *per se* in strong fire, but with much difficulty. That from Saxony seems rather to be a peculiar kind. It melts easily into a flaggy mass.

Sometimes the pitch-stone is found semi-transparent, but more generally opaque, of an imperfect conchoidal texture.

Its spec. gr. = 2,300.

Its various colours are white, yellow, copphony brown, greenish, seldom transparent. It is so hard as to scratch glass. Some mineralogists suppose it to be composed of quartz, feldspar, porphyr, jasper, and iron.

It yields by analysis 64,58 siliceous, 15,41 argillaceous, and 5 of iron.

SPEC.

SPEC. XXIX.

PREHNIT.

GMEL. *Zeolitus viridis.*French. *Zeolithe verdâtre.*

This stone is called after Captain Prehn, who brought it first to Europe in the year 1783, from the Cape; and Mr. Werner, who saw it first at Dresden, gave it this name.

This stone bears some resemblance to zeolith, on which account it has been considered as a variety of the zeoliths. It is found in solid masses, sometimes crystallized. It has only been found of an apple green, or greenish grey colour.

Its spec. gr. = 2,942. When broken, its surface is a little shining, and has a lamellated, sometimes a fibrous texture. It melts by the blow-pipe, but with a stronger ebullition than the zeolith, but does not exhibit a gelatinous appearance, when dissolved in acids.

It is sometimes so hard as to strike fire with steel. It is generally semi-transparent and brittle.

By analysis it has yielded 43,83 siliceous, 30,33, argillaceous, 18,33 calcareous earth, 5,66 iron, 1,83 water.

It is found at the Cape, and in Dauphiné. Its primitive figure seems to be the rhomboidal four-sided plate, but it exhibits generally various modifications of its primitive figure.

Of the crytallized kind there are known,

1. The perfect four-sided rhomboidal plates.
2. The same, but truncated.
 - a. On all the end edges, or
 - b. Merely on the sharp end edges.
3. The irregular six-sided plates.
4. In broad four-sided columns, a little cuniated on the ends from the narrow side faces; the edges are a little truncated; the crytals are always small, very seldom separated, generally accumulated, and adhere by their side faces.

The surface of the crytals, found in a divided state from each other, is smooth. Those crytals, however, which are found adhering to each other in various directions, have a striated surface.

SPEC. XXX.

ZEOLITE, ZEOLITHUS.

This stone has probably its name from the Greek words *Zeos* and *Litos*. It was first described by Cronstedt in the year 1756. Certain kinds of it bear some resemblance to shörl, though they differ from it in various properties.

The colour of the zeolithus is generally opaque, seldom semi-transparent; it is hard, but seldom so hard as to strike fire with steel.

Its spec. gr. = 2,500, sometimes more.

It is soluble without effervescence, in acids, which reduce it to a gelatinous mass. When exposed

exposed to a very strong heat, it melts *per se* into a white opaque slag. In melting, it emits a phosphorescent light, and like borax melts with ebullition. It dissolves more easily with soda than with borax or microcosmic salt, but does not ferment with the two latter substances.

According to certain analysis it contains 50 parts siliceous, 20 argillaceous, 8 calcareous earth, and 22 of water, and Bergman found in it besides a small portion of iron. It generally exhibits pyramidical crystals, which are disposed in a radiated manner, so as to appear spherical. It is found in various places, but particularly in the volcanic products, wherefore it was considered as a volcanic product; the finest kind is found in Iceland, in Sweden, and in the Ferroe Islands.

Its primitive figure, according to La Metherie, seems to be cubical. It is generally found exhibiting various modifications of that figure.

It is generally found of a white pale green, silver white, and honey colour; at Adelsford in Sweden, it is found of a red colour; of a blue in Hungary in some copper-mines; of a yellow colour near Schaafhausen.

It is found in a state of decomposition, coating other stones. It is found solid and fibrous, radiated, lamellated, reniform, stalactitical, in drops, and of a capillary shape, in which it is very beautiful.

✱

It

It is found in basalt, from Riesend, and on the coast of Antrum.

It is also found crystallized, or of regular shape.

a. Cubical; sometimes so altered by truncation, as to exhibit parallelopiped.

b. In six-sided and flat prisms.

c. In needle-shaped prismatic crystals, disposed in a diverging manner. The prisms are four-sided, terminating in two or four-sided pyramids.

d. Of a prismatic and capillary figure, it is found in the cavities of volcanic stones.

e. Of rhomboidal figure, with the one angle of 74, and the other 106.

SPEC. XXXI.

LAPIS LAZULI.

WALLER. *Zeolite particulis subtilissimis colore albo et cæruleo argentum continens.*

GMEL. *Lazurus.*

French. *Pierre d'azur.*

CRONSTEDT. *Zeolithes particulis impalpabilibus argento et ferro mixtus.*

This stone has probably its name from the Arabian language, in which *azul* signifies *sky-blue*.

It

It has been differently arranged; some mineralogists have considered it as a variety of the zeolites.

Gmelin has placed it among the calcareous stones; others have ranked it among the iron-stones.

Cronstedt observed that it resembled most the zeolites, which it certainly does.

Its spec. gr. varies, but generally = 2,100 or 2,771.

It differs from the zeolite in containing selenite as a component part, and also iron.

It is opaque, and never found crystallized. It generally is found in solid masses, seldom pure, generally full of veins of quartz, lime-stone, and marcasite or pyrites.

Its colour is sky-blue, which it retains in the fire for a long time, but at last it becomes brown.

The best kind, when calcined and immersed in vinegar, improves in colour.

It melts easily in the fire, into a white frothy slag.

It does not effervesce with acids, except it contains lime-stone.

It is not very hard, so that its surface can be scraped with a knife, and when it strikes fire with steel, it is owing to the pyrites and quartz which are often found mixed with it, but it is generally harder than most kinds of zeolites, and takes a polish. When boiled in concentrated vitriolic acids, it dissolves slowly, and loses its colour.

Volatile

Volatile alkali extracts no blue colour from it, and the colour seems to arise from the iron particles or pyrites.

It decomposes sooner than the zeolite, when exposed to the air; when broken it exhibits a dull surface.

It is found with the Bucharian Calmucks, in Asia, as on the Altai and in Kultach; in Persia Natolien in the Eastern countries; in Hungary, Italy, Bohemia, Saxony, Tyrol, England, and in America at Atakama in Chili, generally in large layers, or forming part of rocks. It is used for extracting that fine colour called ultramarine from; it is also manufactured into various vessels, and used in mosaic works, &c.

The lapis armenius is considered to be a different stone by the ancients, called *chrysocola*, *oriental saphir*; Fr. *verd-azur*; Germ. *mountain-blue* or *berg-blau*. It is much softer than the real lapis lazuli, almost softer than marble. It decomposes sooner than the lapis lazuli, and is of a blueish colour, which however soon changes into green and grey.

It never contains pyrites. The colour which is extracted from it is much inferior to the ultramarine, and changes very soon. It is found in England and Tyrol, in large pieces, and in nests.

GENUS IV.

ARGILLACEOUS GENUS.

Or Earth and Stones, mostly consisting of Argillaceous Earth.

THE earth and stones which are described under this head, are never found to consist merely of argillaceous earth, which may be considered as the basis of them; they are found mixed with more or less flint, magnesian and calcareous earth, and occasionally oxyd of iron. But the other substances are generally so slightly combined with the basis, that the argillaceous earth can be extracted from them, by sulphuric acid, with which it forms Alum.

Though the stones ranked under this genus, differ amongst themselves very much in their appearance, however they exhibit in general some characters by which they may be distinguished from those of the foregoing genus.

M

Very

Very few of them exhibit a vitreous appearance, or strike fire with steel, except such as have been rendered hard by fire.

They have generally an arid or earthy appearance when broken, and emit a peculiar earthy smell, when moistened; they become very hard when exposed to a strong heat; they hardly effervesce with acids, a few only excepted, which contain a little carbonic acid, and this may be accounted for, from the admixture of other substances which they contain; as the basis, namely the argillaceous earth, discovers no affinity to carbonic acid.

The softer kind adheres more or less to the tongue, absorbs water, some of them, with a noise; they become more or less soft, when mixed with water; and by virtue of coherency, clays retain humidity, on which perhaps their chief power of promoting the growth of plants depends; they seldom exhibit a *regular shape*, and seldom what we have called, a *particular shape*; they are more or less greasy to the touch, and the hardest kind can be scratched with a hard knife.

As to the other chemical properties of the basis of these stones, they are mentioned in the first part of this work.

The

The schistous kind contains impressions of plants. All the substances belonging to this genus, may be divided into two general divisions.

1. Into such as we shall call clays, and which are more or less soft.

2. Into such as are more or less indurated, and exhibit sometimes a regular figure.

The clays we shall again divide,

1. Into such as have an arid appearance, and effervesce a little with acid.

2. Into such as are soapy to the touch, and do not effervesce with acids.

3. Such as have an admixture of bitumen.

4. Such as contain sulphuric acid, in the state of alum. And

5. Such as contain a greater portion of flex, and are found according to their degree of combination, of a more or less degree of hardness.

I. DIVISION.

The substances belonging to this division, are generally of a milk-white colour, effervesce a little with acids. They are soluble in nitric acid, and are in that state separated again by

M 2

sulphuric

fulphuric acid in the state of alum; to this belong

SPEC. I.

PIPE CLAY.

Waller. *Argilla Apyra.*

Germ. *Pfeiffen Erde.*

Its colour is white, it is very little greasy to the touch, friable, and stains the fingers. It effervesces a little with acids; when kneaded with water, it becomes clammy, so as to be fit for moulding into different vessels, which when exposed to heat, become hard, and the surface only becomes a little vitrified, when exposed to a very strong heat.

When first exposed to heat, it becomes greyish or blackish, owing to the inflammable matter which it often contains, but by the continued heat, it is deprived of it, and becomes perfectly white.

It is used for tobacco pipes, and that which is most clammy, is found to be the best for that purpose.

When this clay is mixed with sand, it serves for making crucibles, or other vessels which resist a very strong heat. It is found
in

in Normandy, and the environs of Cologne, in Livonia, and in various other parts of the world.

SPEC. II.

PORCELANE CLAY.

Gmel. *Argilla Porcelana.*

Waller. *Argilla Apyra macra pura.*

French. *Terre a Porcelaine.*

Kaolin, by the Chinese.

Its colour is generally white, sometimes inclining to greyish—yellowish—and reddish white.

It has an arid appearance, is soft to the touch; when exposed to heat, it does not change its colour, and becomes perfectly white, effervesces less with acid, than the foregoing kind; it contains half its weight of silic. earth, on which account, when first mixed with water, and moulded into certain vessels, and then exposed to a strong heat, it assumes the appearance and nature of a semi-transparent glass; strikes fire with steel; is not acted upon by acids; and suffers no alteration or change as to its shape.

On account of this property, it is used for china-ware, which will bear a sudden change of hot and cold water. It seems to originate from the decomposed feldspar. It is found pure in *Japan*, in great quantity, also in *China*; but that from the latter country, contains micaceous particles.

In Saxony it is found of a flesh colour, of which the porcelane is there made. It is also found in other parts of Germany, particularly in Austria, where it is used for the same purpose; but being rather of an inferior kind, to that of *Meissen* and *Berlin*, it is distinguished by the name of *Fayence*.

A very fine white sort is frequently found in the Ukraine, near Gluchow, which is used in the china manufactory at Moscovia. Another kind is found in Siberia, in the province Tschibarkul, which is used in the manufactory of St. Petersburg. Another kind of straw colour is found near Tschibarkul, which becomes red when exposed to heat, and may be used to imitate the brown chinese ware.

SPEC.

SPEC. III.

NATIVE ARGILLACEOUS EARTH, or
PURE CLAY.

Lat. *Lac Lunæ, Agaricus Saxatilis.*

Gmel. *Terra aluminaris nativa.*

Germ. *Mond-Milch, Mehl Kreide.*

Born. *Catal. raisonné. Allumine Native
pure & blanche.*

This earth has generally been ranked amongst the calcar. earths. It is of a milk white colour, has an arid appearance, is earthy to the touch, and stains the fingers; is light and friable, hardly effervesces with acids. It is found to be composed according to Schreber, of argil. a little calcar.—and feruginous earth, combined with carbonic acid.

Its spec. gr. is equal = 1,669.

A red kind is found in Gothland, the white kind is found near Roedon in Yemteland, Timmerdala, in Westro Gothia, Smoland, and Oostro Gothia. In the isle of Gothland, in the Baltic; it is found at the bottom of stagnant waters, and in the sea.

It is also found in kidney shaped pieces, and becomes a little semitransparent, when softened with hot water; in the Silesian Principality of Münsterberg, in England, in Lombardy; also in the garden belonging to the Pedagogio at Halle, but this contains a little quartz, sand, and selenite.

SPEC. IV.

LITHOMARGE.

Gmel. *Argilla Lithomarga.*

Waller. *Archilla Lapidea.*

Germ. *Steinmark.*

This substance has a white or yellow colour, a fine texture, of different degrees of coherency or hardness. It is soluble in nitric acid with effervescence. It alters its colour in the fire, becomes very hard, and melts by increased heat, into a red porous slag resembling lava. It is found in clay and limestone rocks, in long layers, between clay and limestone. Mr. Volta mentions, that it is found, though very scarce, in eight sided prismatic crystals, called *Marga crystallifata octoedra*, by *Hardinger*. Also in four sided prisms called by *Waller*. *Tophus ludus Helmontii*.

It

It is used in potteries and china-ware manufactures.

Mr. *Werner* divides the Lithomarge into two varieties.

VAR. 1. FRIABLE LITHOMARGE.

Its colour is yellowish, greyish, or whitish; its texture is glittering, scaly, the particles are mostly coherent, seldom quite loose.

It adheres to the tongue; it is found in nests in other stones, viz. in grey wacke on the Harz.

VAR. 2. INDURATED LITHOMARGE.

This kind is either yellowish white, pearl grey, violet blue, flesh and brownish red, ochre yellow, cream colour, lavender blue, or liver brown.

It approaches to the nature of mountain soap, as it adheres stronger to the tongue than the other kinds of lithomarge; it exhibits often various colours, in one piece, as the *terra miraculosa* from Saxony.

When rubbed in the dark with a pen, it emits a phosphorescent light.

It is found in solid masses, having an arid appearance, and when broken, it exhibits a conchoidal surface.

It

It is perfectly opaque, adheres to the tongue, softens difficultly in water, and absorbs it with a noise. It is generally found in small quantities, except at Planitz near Zwickau, where it is found over coal flötz in pretty large masses of flesh colour. Near Rochlitz, it is found in porphyry; in serpentine, at Zöblitz. In larger quantities, it is found in the gangues of tin-stone, at Ehrenfriedersdorf and Altenberg.

II. DIVISION.

This includes those kinds of clays, which are soft and soapy to the touch, absorb the water rapidly, and retain it for a long time; when kneaded with water, become clammy and harden in the fire. They decompose nitre and common salt, like the vitriolic acid, when distilled together, on account of their having a stronger affinity to the alkaline salts, than the acids with which they undergo a vitrification.

SPEC.

SPEC. V.

COMMON CLAY, BRICK CLAY, POT-
TERS CLAY.

Lat. *Argilla vulgaris plastica.*

Its colour is generally pale, sometimes deep and greenish white, pale yellowish grey, deep blueish, and smoke-grey. It is found in large layers, and forms sometimes the bed of rivers, and according to some authors, the bottom of the ocean is also composed of it.

It has a dull appearance; when broken, it exhibits partly a fine, partly a coarse texture, is soft, and when moistened, it becomes soapy to the touch, and adheres to the fingers; when exposed to a strong heat, it becomes red, and by a very strong fire, melts into a slag.

When moist and exposed to the sun, it shrinks and cracks irregularly in all directions. It does not effervesce with acids, is frequently mixed with iron ochre, also vitriolic acid and sand. As its composition is not always the same, it is necessary to mix it with other clays or sand, in order to make tiles of it; the more sand incorporated with it, the better are the tiles, as they vitrify more readily, and absorb
less

less water. When the mixture is well chosen, the tiles must not bend when red hot, nor should they crack; they must be sonorous, and not attract moisture. The blueish kind is for that purpose the best. It is used instead of lime for mortar, bricks, and for other purposes in the earthen ware manufactories.

SPEC. VI.

MARTIAL CLAY, PAINTERS CLAY.

Germ. *Mahler Thon.*

Lat. *Argilla pittoria.*

Waller. *Argilla mineralis.*

This kind is rather a little rough to the touch, more dry than the common clay, has a disagreeable smell, absorbs and mixes with water with a noise, softens slowly, and alters its colour. It contains the feruginous earth in different proportions, hence its different colours. It is found in cliffs of the clayey and feruginous mountains, and seems to originate from the decomposition of ores and iron pyrites. The *umbra earth* belongs also to this kind, which is found on the clay shores near Roptsch in Ingermania, &c.

And

And also the green earth (*Argilla veronensis*)
Germ. *Grünerde*. Ital. *Terra verde di Verona*.
French. *Terre Verte*, which is found of a glo-
bular form in the almond stone of the Wacke
kind. It is found at Planitz near Zwickau,
also frequently on the *Monte Baldo*, in the en-
viroins of Verona, in Tyrol and in Bohemia.
It has yielded by analyfis 20 argill. 8 calcar.
3 filic. $3\frac{1}{2}$ magnesian earth, and 1, 2 iron.

Also the yellow earth, which is found in
Werau in Upper Laufatia on the Ziegelberg.
The *Terra Miraculosa*. Germ. *Wundererde*,
which is found in Saxony, and which has its
various colours from the metallic earth altered
by the air, belongs to this species.

SPEC. VII.

BOLE.

Lat. *Bolus*.

Born. *Argile martiale et Lithomarge*.

This substance is found of different colours
in the clay mountains in Germany; the red
kind is called *Armenian Bole*, which is used for
red pencils. The *Terra Lemnia*, which is
composed of 47 filic. 21 argil. 6, 2 magnesian

5, 4 calcar. earth, 5 iron and 17 of water, belongs also to this kind. The particles of the bole are very small, and cohere very slightly; it softens on the tongue, and adheres a little to it; it softens easily in water, but is not fit for pottery. It absorbs water, it hardens in fire, and is then attracted by the magnet; melts into glass by a strong heat.

To the indurated or harder kind, belongs the red chalk (Fr. *Crayon rouge*) which has an arid appearance; is somewhat hard and brittle, and intimately mixed with oxyd of iron.

The red boles are found in Russian Finland, on the frontiers of Sweden, in Livonia, the Crimea, and the Ural.

The *Terra Sigillata*, which is kept in apothecarys' shops, is of this kind, but of the finest sort: it is moulded into flat round pieces, with an impression in order to prevent its imitation.

SPEC.

SPEC. VIII.

SOAP ROCK. *Fullers earth, mountain soap.*Germ. *Seifen Thon.*Born. *Argile savonneuse.*

This is of a grey or yellowish colour, is dry, rather hard, however it can be scratched with the nails; it is shining when scraped with a knife, and slippery between the fingers, or soapy to the touch; it adheres strongly to the tongue. When beaten with water, it makes a lather like soap; it has also the property to combine with fat substances; it does not stain the fingers; falls to powder when exposed to the air; softens in water, and hardens in the fire.

It contains magnesia, from which it has its soapy property; it is frequently found in England, and in various parts of Germany, Bohemia, and Poland. The best kind is found in England. It was used by the ancients to bleach linen, and is still used for that purpose by the inhabitants of the Crimea and others.

Some of the indurated clays are composed of layers, or have a stony texture, viz.

SPEC.

SPEC. IX.

SLATY CLAY.

Germ. *Schiefer Thon.*Lat. *Argilla vulgaris schistosa.*

Its colour is generally blueish and ash grey, or greyish black. It is found solid, generally in large layers; when broken, it has a dull appearance, very seldom glittering. Its texture is slaty, it is opaque, soft, adheres a little to the tongue, and contains frequently impressions of plants, such as *equisetum*, *adanthum nigrum*, and various filices. It is found over and under the coal flötz, sometimes penetrated with bitumen; another kind composed of thin layers, containing more silic earth, viz.

SPEC. X.

ARGILLACEOUS SCHISTUS.

Germ. *Thonschiefer.*French. *Ardoise argilleuse.*

This is harder than the foregoing, and is found of various colours, generally greyish black, greenish, blueish, yellowish, and reddish

dish grey, seldom of a deep crimson red colour, and very seldom spotted. It is found solid and interspersed, generally in layers, and gangues; It forms besides the grey wacke, the principal rocks on the Harz (and so seems the Killas, one of the general gangues of the tin ores in Cornwall, to be of the same nature, containing partly mica and quartz intermixed.) When broken, it is sometimes a little shining; has seldom a perfectly dull appearance; sometimes exhibits a silky or metallic lustre. Its texture sometimes appears curved or undulated; the fragments are generally orbicular, seldom long shivery, trapezoid, and very seldom rhomboid. It leaves a greyish white trace upon the touchstone, feels a little greasy; when powdered, it is acted upon by acids.

It is composed, according to Kirwan, of 60 filic. 25 argill. 9 magnesian earth, and 6 of iron. It is frequently found in Saxony, composing a considerable part of the primitive mountains. At Gersdorf, it is found of a blueish grey colour, resting upon gneis.

The best varieties, respecting colours, are found near Schneeberg. It is used for covering roofs.

DIVISION III.

Argillaceous stones, containing bitumen, or petroleum, called

SPEC. XI.

BITUMINOUS SHISTUS.

Germ. *Brandschiefer.*

This stone is generally of a brownish black colour. It is found solid, forming flötz or stratified mountains. When broken, it is a little glittering, has a flaty texture, and breaks in orbicular plates; is opaque, soft, a little greasy to the touch, and when exposed between red hot charcoal, it becomes white, and emits a strong smell. It seems to be composed of argillaceous shistus, penetrated with bitumen, and sulphur-pyrites.

It is only found in flötz mountains, viz. at Werau in Upper Laufatia, at Wettin in Hesse. In Yorkshire; it is strongly impregnated with bitumen, so as to burn like coals.

DIVISION IV.

Argillaceous earth united to sulphuric acid.

SPEC.

SPEC. XII.

ALUMINOUS EARTH.

French. *Terre alumineuse.*

Germ. *Alaun Erde.*

It is generally found of a deep grey, brown, or blackish colour; has a dull appearance, seldom a little glittering, originates from decomposed aluminous shistus; it is distinguished by the efflorescence of alum, and is found in flötz and aluvian mountains, as at Moscovia, Upper Lusatia, where it is used for the alum manufactory.

SPEC. XIII.

ALUMINOUS SHISTUS.

Germ. *Alaun Schiefer.*

French. *Ardoise alumineuse.*

Lat. *Argilla Schistus aluminaris.*

VAR. I. COMMON ALUMINOUS SHISTUS.

Its colour is blueish black; it is found solid, and in globular masses; when broken, it is a little glittering; has a flaty texture partly

N 2

straight,

straight, partly curved; it breaks in trapezoid pieces, gives a black trace, is generally soft, and has a sweetish nauseous taste. It is found generally accompanying coals; it seems to be argillaceous shistus, penetrated with sulphuric acid. It is found in Norwegue, Sweden, Scotland, England, and in various parts of Germany.

It is also employed for alum works.

VAR. 2. GLOSSY ALUMINOUS SHISTUS.

Germ. *Glänzender Alaun Schiefer.*

Lat. *Argilla Aluminaris Schistosa nitida.*

This kind is generally blueish black, sometimes iron black; is found solid in large layers, and exhibits somewhat of a metallic lustre; its texture is flaty, it breaks into indeterminately shaped pieces, is a little greasy to the touch, is partly soft, partly hard; it is composed of argillaceous earth, vitriolic acid, ferruginous earth, and a little combustible matter; it is found at Reichenbach, Saalfeld, and other places.

SPEC.

SPEC. XIV.

ROCK-ALUM.

Germ. *Alaun stein.*

French. *Pierre calcaire alumineuse.*

Its colour is yellowish, greyish, reddish, sometimes white, resembling chalk, adheres to the tongue, and consists of 22 filic. 35 alum. earth, and 43 of sulphur.

It is found near Tolfa in the dominions of the Pope, and is considered as the best alum stone; it forms there mountains, containing gangues of quartz. It is also found in a certain part of Tuscany.

SPEC. XV.

BLACK CHALK.

Germ. *Zeichen Schiefer, or schwarze Kreide.*

Lat. *Argilla nigrica.*

French. *Crayon noire.*

Its colour is greyish black, sometimes blueish black, is always found solid, when broken has a dull appearance; its texture is curved, slaty, opaque; it is used for drawing, is soft,

becomes red in the fire, and is then called soft bloodstone; it contains besides the vitriolic acid, inflammable matter, and iron. The best kind is found in Italy.

DIVISION V.

Argillaceous Earths united to a greater portion of Silex, and are therefore of a harder nature.

SPEC. XVI.

WHETSTONE.

Germ. *Wetzschiefer.*

Lat. *Argilla coticula.*

French. *Pierre a Rasoir.*

Its colour is generally greenish grey, seldom spotted; it is found solid in large layers, when broken, the surface appears a little glossy; its texture is flaty, approaching to shivery; it breaks in orbicular plates, is a little semitransparent on the edges, it gives a greyish white trace, does not adhere to the tongue.

The best kind is found in the Levante; near Lauenstein in Bareith, in Siberia on Tom; near Freiberg in Saxony.

SPEC.

SPEC. XVII.

TRIPOLI.

Germ. *Trippel.*

French. *Terre de Tripoly.*

Lat. *Argilla Tripolitana.*

Waller. *Tripola solida.*

This stone has its name from a place called *Tripoli*, whence it was first brought to us.

Its colour is whitish, yellowish grey, cream and ochre yellow; is found solid, has a dull and earthy appearance when broken; it breaks in indeterminate obtuse angular pieces, is soft and sandy between the teeth, absorbs water with a noise, during which air bubbles are expelled, is harder than the other clays, and may be easily powdered; it is not readily acted upon by acids; when exposed to strong heat, it becomes white, and melts with chalk in fire.

Its specif. gravity = 2080.

It contains 66 parts of silic. 7 argill. 1,5 magnesian, 1,3 calcar. earth, 2,5 iron, and 19 of water. It is found in the island Tanna, in the south sea, and in the north of Africa, at Naples, in Saxony at Potschappel near Dres-

den, in the environs of Naumburg, in Bohemia, and in various other German provinces.

It is much used for polishing; it is supposed by some mineralogists to be of volcanic origin.

SPEC. XVIII.

MICA, GLIST.

Germ. *Glimmer*.

Lat. *Argilla mica*.

This Substance which exhibits a lamellated structure, is found of various colours, most commonly greyish, blackish, yellowish brown, silver white, also of the tombac colour; it is found in solid masses, but never forms whole rocks; it is found of irregular shape, interspersed through other stones, particularly in the granits, of which it is a component part; and sometimes it is found of regular form.

It is always shining; sometimes it exhibits a metallic lustre; it easily divides into thin lamellæ, which are either straight, curved, or undulated, seldom radiated.

The laminæ are sometimes found of considerable size; it is generally semitransparent, except a species of it, the *Muscovy glass*, when in thin laminæ, is quite transparent; its
surface

surface can be scratched with a knife; the lamellæ are flexible and elastic.

Its specif. gr. varies generally $\approx 2934:1000$.

It is not readily acted upon by acids; by means of the blow pipe it is not quite soluble in soda, and it melts with microcosmic salt and borax without ebullition. The white kind melts very difficultly, but the black kind easily, probably on account of the iron which it contains. On analysis it has yielded different component parts, and also in different proportions. The silver white kind has yielded 40 parts of silic. 46 argill. 0,5 of magnesian earths, and 9 of iron.

The Muscovite mica has yielded 50 parts silic. 45 magnesian, and 0,5 of argill. earth.

That which is found of regular shape, composed of six sided lamellæ, from Altenberg in Saxony, has yielded 40 silic. 46 argill. 0,5 magnesian earth, 0,9 manganese.

Mica is found in various places in Siberia, on the alps in Tyrol, Zitterthal, and Altenberg in Saxony, and Zinnwalde, most frequently in granits and gneiss.

Its regular figure is the six sided plate with the angles of 120° , but it exhibits sometimes
four

four sided and six sided columns composed of lamellæ.

The yellow kind with a metallic lustre, is called in German, Katzengold, and the silver white, Katzenfilber.

That which is found in Siberia in large thin plates, is used for windows, and upon other occasions, where panes of glass are wanted.

SPEC. XIX.

CIANIT.

Werner. *Talcum cyanites.*

Germ. *Kyanit.*

By Saussure. *Sappare.*

Gmel. *Zeolithus cyanitus.*

This stone is composed of long laminæ, of a milk white colour, with shades of sky or Prussian blue; it has a lustre similar to mother of pearls; the lamellæ are semitransparent in different degrees, rather brittle; it is rather soft and can be scraped with a hard knife; to the touch it resembles somewhat the harder kind of talc.

Its specif. gr. = 3517.

It melts *per se* very difficultly in fire, and
does

Of the Argillaceous Genus.

does not lose its colour. It is not readily acted upon by nitric, and muriatic acid.

Mr. Saussure found by analysing it, 13 part silic. 67 argill. 13 magnesian, and 5 of feruginous earth; others have found, besides those component parts, a little calcar. earth.

Its matrix is generally granit and gneiss; it is found near Lyon, on St. Gotthard, at Zitterthal in Tyrol, on the Carpathian mountains, at Nertschink in Siberia, and in Transilvania, also in Scotland.

It is found in solid masses, exhibiting no particular shape, and the lamellæ are long, of different breadths, irregularly placed, one over the other, sometimes in a radiated manner; this kind is found in Scotland.

Of regular shape it is found on St. Gotthard's, and in the aforementioned places.

This kind is more transparent, becomes opaque in the fire; its regular figure is an oblong four sided prism, composed of lamellæ placed longitudinally; the surface is longitudinally striated; it differs much from the shörls, by the different degrees of the side angles.

SPEC.

SPEC. XX.

HORNBLLENDE.

Lat. *Argilla Hornblenda.*

French. *Roche de Corne Striée.*

Swed. *Stralkimmer.*

De Lisle and Born. *Shörl feuilleté.*

The name Hornblende, was formerly given to those kinds of shörls, which exhibited a spacious foliated appearance, and a green or black colour. This stone is found of various degrees of hardness, but never so hard as to strike fire with steel; its surface cannot be scraped with a knife, when dipped into hot water, it emits a clay smell, is difficult to be reduced into powder, on account of its toughness, in which it resembles horn; it melts per se.

Mr. Werner describes four varieties.

VAR. I. COMMON HORNBLLENDE.

Lat. *Argilla hornblenda vulgaris.*

Waller. *Corneus facie spathosa striata.*

Cronstedt. *Bolus indurata particulis squamosis.*

This

This is found blackish, and of a deep green colour, mostly opaque; it is found in solid masses, interspersed through other stones, also crystallised of prismatic figure; in its crystallised state, it is subject to the following modifications:

1. Exhibits six sided prisms, the ends acuminate by three faces.
2. Six sided prisms terminating by one end in a three sided pyramid, and on the other end, exhibiting two faces.
3. Six sided prisms terminating on one end by four faces, the other end exhibiting many faces.
4. Six sided prisms on both ends, terminating in three sided pyramids, having the edges truncated.
5. Eight sided prismatic on both ends, terminating by two faces.

The crystals are internally shining; the texture exhibits divergent radiations. It is sometimes foliated, and the lamellæ are either parallel or curved.

It differs from the shörl, which has a shivery texture, and the hornblende is either radiated or foliated; it differs also from it with regard to its crystallisation. The crystals of shörl are longitudinally striated, those of hornblende
transf.

transversally; the hornblende is softer than the shörls.

The hornblende is found mixed with trapp basalt, and that kind of granit which Mr. Werner calls *Sienit*.

It is frequently found in Saxony, in Upper Lusatia, and in Joachimsthal in Bohemia, in Sweden, &c.

It has yielded by analysis 52 filic. 23, 33 argill. 6 calcar. earth, and 17, 5 iron.

VAR. 2. HORNBLLENDE SHISTUS.

Germ. *Hornblende Schiefer*.

Lat. *Argilla Hornblenda Schistosa*.

This kind is of a greyish black, seldom deep green colour, is found in whole layers, in rocks of gneiss, and micaceous shistus; when fresh broken, its surface is shining, its texture appears irregularly radiated. It is brittle and compact. It is found in various places near Freyberg, &c.

VAR. 3. LABRADOR HORNBLLENDE.

Its colour is generally greyish black, sometimes a little shade of copper-red, a little resembling Labrador stone. Its texture is lamellated;

melated, the lamella often curved, a little semi-transparent on the edges.

It is found on the coast of Labrador.

VAR. 4. BASALT HORNBLENDE.

Lat. *Argilla Hornblenda Basaltica.*

Its colour is blackish green, sometimes deep black. Is only found crystallised in 6 and 8 sided prisms, cuniated on the ends.

When broken, its surface is shining; when longitudinally broken, the lamellæ parallel.

It is found in basalt, tuff, wacke, and lava.

It has yielded by analysis 58 filic. 27 argil. 1 magnesian, 4 calcar. earth, and 9 iron.

SPEC. XXI.

TRAPP.

Waller. *Corneus Trapezius.*

This stone is by some mineralogists considered as a variety of the basalt, which it resembles in many respects; but, as it exhibits some marks by which it may be distinguished, it may be placed here with some propriety, though I shall have occasion of mentioning it again, by the component parts of the mixed rocks.

Its

Its name originates from the Swedish language. The term *trapp* describes a stone, which breaks in pieces of a rhomboidal figure, and consequently exhibits, when in the state of rocks, steps like a stair case.

Its colour is blackish brown, blackish grey, and blackish green; in hardness it varies; it generally scratches glass.

Its specific gr. = 2,745.

It is never found of regular shape; it melts into a glass, and may be used for the common green glass.

It generally effervesces with acids, and can with greater ease be reduced to powder than basalt. It emits no earthy smell when moistened. By analysis it has yielded 52 silic. 15 argill. o, 8 calcar. earth, and 16 iron.

It contains frequently other stones, as hornblende, mica, chalcedony, calcareous spar, as the toad-stone in Derbyshire; hence its porous appearance, which it exhibits occasionally, when either of the substances are decomposed.

It is generally found in the gangues and flötz mountains; sometimes it forms the basis of basalt rocks, and it contains occasionally veins of ore.

It is, perhaps, by subterraneous fire, changed into basalt.

A softer

A softer kind of this stone, of a brown or reddish colour, is called *Wacke*, on the Erzgebürge, occurs frequently in Bohemia.

SPEC. XXII.

BASALT.

Lat. *Basaltes*.

This stone has lately been much noticed, and certain mineralogists considered it to be trapp, which has been altered by the subterraneous fire; and according to the variety of that stone, the basalt exhibits various colours; it must also hence obtain a different texture, gravity, and hardness.

Sometimes it is found so little altered, that it can hardly be distinguished from trapp or wacke.

Its colour is generally greyish black, also greenish black, perfectly opaque. It is often found so hard, as to strike fire with steel; and takes a good polish; it is not readily acted upon by nitric acids, and melts into a blackish glass, before the blow-pipe.

Its specific gr. is generally $\approx 2,743$.

So is that basaltes which is found at the Giants Causeway. It has yielded by analysis 50 parts

O

filic.

filic. 15 argill. 2 magnesian, 8 calcar. earth, and 25 of iron.

The basalt is found in solid masses, also column shaped, and the columns are frequently found placed perpendicularly over granit, gneiss, lime-stone, and bituminous wood.

The basalt forms often isolated mountains of a conical figure.

The columns are not regular, or the number of sides is found various, exhibiting no particular marks of crystallisation.

As to its origin, mineralogists differ in their opinion.

From a variety of characters, as well as from its appearance and component parts, it may be supposed to be produced by subterraneous fire; or it may be considered as of volcanic origin, in which case, its component parts, which, by fire, were reduced to a fluid state, on cooling, cracked into column shaped pieces.

Basaltes have lately been discovered, which have holes through them, similar to pumice, and the cavities contain often crystallised stones; but it appears upon the whole, that some basaltes are formed in the moist way, or, at least, water has contributed something to their formation; and that others are of a volcanic origin.

The

The volcanoes of the present time form no basaltes; perhaps the time when the basaltes were formed, was, when the surface of the earth was covered with water, which cooled the heated mass, and after the retrocession of the water, occasioned its cracks or columnar divisions.

SPEC. XXIII.

TUFFWACKE.

Under this name Prof. Blumenbach ranges all the light, soft, partly porous, partly vesicular, or spongy stones, that are mostly of a grey or brownish colour. They are found frequently near basaltes, and volcanic lavas; which, by certain changes, approach to their nature. They contain often hornblende, olivin, white garnits and pumice.

To the friable kind belong the *Trafs*, or *Tarras*, found on the Rhine, and also that stone which is thrown out by Mount Vesuvius; and from which Pompeja was built, it is called *Tufa*, by the Italians.

The *Trafs*, by Waller, *Cæmentum Tarras*, is a yellow, petrified, porous, sandy, and ferruginous earth, containing often particles of other stones. There are other stones which may be placed with these stones; but they are noticed in that part of the work which treats of rocks, &c.

SPEC. XXIV.

PUMICE STONE. PUMEX.

Germ. *Bimslein.*French. *Pierre ponce.*Waller. *Porus igneus.*Gmel. *Lava pumex.*

This is a slight spongy stone, generally of greyish, blackish, brown reddish yellowish, colour; is sharp or rough to the touch, has a fibrous texture.

Its specif. gr. = 0,914 : 1000.

It does not effervesce with acids, melts into a slag, has all the appearance of having been exposed to the action of subterraneous fire.

It is found in the ashes near Vesuvius, from whence it is washed down into the sea.

It is used for scouring, or cleaning the surface of hard metals, or other substances.

A certain kind has yielded by analysis, 11,66 silic. 82,5 argill. 4,58 calcar. earth, and 1,66 iron.

SPEC. XXV.

LAVA. *Argilla Lava.*

The stones belonging to this species, have been exposed and altered by the subterraneous fire of the volcanoes; they differ in appearance
and

and nature, according to the substances of which they were composed, previously to their having been melted by the fire; most of them have a vitreous appearance, more or less, according to the degree of heat.

They may be divided into three kinds.

VAR. 1. SPONGY OR POROUS LAVA.

This kind is a hard, heavy, vitreous slag, which flows from the crata of Vesuvius. The surface is quite vitreous, uneven, porous, and vesicular; sometimes stalactitical; it is used for plastering, &c.

VAR. 2. COMPACT LAVA.

Germ. *Steinige Lava. Scoria Breccia.*

Wall. *Saxum vulcanorum.*

This kind is a compact opaque, mixed mass, of various colours, mostly greyish and reddish brown; contains often, *hornblende, white garnets, olivin, also calcareous spar, mica, shörl.*

VAR. 3. VITREOUS LAVA. *Scoria vitrea achates Islandicus.*

This kind is black, sometimes greenish, a little semitransparent; it breaks into conchoidal pieces, resembling compact glass. This stone must not be confounded with the *obsidian* of Werner, which is electric, and not a volcanic product.

GENUS V.

MAGNESIAN GENUS.

THE stones which are ranked under this genus, have, for their principal constituent part, or basis, the magnesian earth, whose distinguishing properties, when in a pure state, have been mentioned in the beginning of this work.

The magnesian stones are always mixed with some other substances, generally with siliceous earth, a small portion of calcar. earth, and more or less oxyd of iron; they have their colour from iron. The affinity which the magnesian earth certainly has to the carbonic acid, must be very weak, as there are very few stones of the magnesian kind, which effervesce with mineral acids; hence the affinity of this earth to the other admixed substances, must be stronger, supposing the carbonic acid to be present, and not driven off by heat.

When the component parts of the magnesian stones are not intimately blended, the magnesian earth, if they be previously pulverized, can

can be extracted from them by sulphuric acid, with which it makes the So, called Epsom salt, *Sulphate of Magnesia*, which has a bitterish taste; when the magnesian earth is dissolved in nitric acid, and a paper is dipped into a saturated solution of it, it burns, when dry, with a green flame.

The magnesian earth does not melt *per se*; and when magnesian stones are found to melt, it is owing to heterogeneous substances, such as siliceous earth, or oxyd of iron, &c. These stones also melt with borax, when exposed to heat. They do not, like quick-lime, become hot when moistened with water, nor are they afterwards rendered soluble in water.

The magnesian stones form deliquescent salts, when dissolved in muriatic or nitric acid. They do not harden so much in the fire as the clays.

Most of the stones of this genus exhibit a greenish colour; most of them are greasy and soft to the touch, do not adhere to the tongue, and a few only are hard, such as the asbestos and the jade; but even these very seldom strike fire with steel. They are only semi-transparent; in different degrees, none of the magnesian stones have been found to contain petrifications; they hardly ever exhibit a regular form.

The following species and varieties are known and distinguished from each other by certain marks.

SPEC. I.

STEATITE SOAP STONE.

From the Greek language, *Steatos*, fatty stone.

Gmel. *Taleum Smectis*.

Cronst. *Argilla indurata particulis impalpabilibus solida*.

French. *Pierre de Lard*.

Germ. *Speckstein*.

Swed. *Skräddare Krita*.

Hung. *Szalonnackö*.

In this stone the component parts are so equally mixed, that they cannot be distinguished with the naked eye. It is found of various colours, viz.

1. Light white in *Bareith* on *Fichtenberge*.
2. Greenish white, with deep shades, at the same place.
3. Yellowish white, red spotted, in *China*.
4. Olive green, from *Johann Georgenstadt*.
5. Mountain green, in *Zöblitz* in *Saxony*.
6. Light

6. Light greenish grey, in the *Isle of Sky*, in *Scotland*.

7. Yellowish grey, in *Cape Lizard*, in *Cornwall*.

8. The lamellated kind is only found of a green colour in *Zöblitz*, and *Norwegue*, &c.

It is only semi-transparent when in thin lamellæ. It is soapy to the touch, does not adhere to the tongue—very seldom found to leave a trace on the fingers; it is rather soft, so that it may be easily cut into vessels; never so hard as not to be scratched with a knife.

The softer kind becomes harder in the air; absorbs water very slowly; does not soften in it, nor effervesce with acids.

Its specific gr. is = 2,600, 1,000.

When exposed to heat, it becomes more opaque, and loses its unctuosify. It melts with borax and soda into a green slag; it contains more siliceous earth than the talc, and is much harder; is soluble in acids, but very slowly and without effervescence. It is found in compact layers, interspersed, kidney shaped, seldom of regular shape, in six-sided prisms, terminating in six-sided pyramids. It has a shivery texture. It is found in *Cornwall* in *England*, *Thiersheim* on *Fichtelberg*. In *Saxony* in *Johanngeorgenstadt*,

stadt, Zöblitz, the best kind is found in China. That from Bareith has yielded by analysis 58, 33 silic. 39, 16 magnesian earth, and 2, 5 iron.

Some mineralogists found Nickel in its composition.

Mr. Werner and Karsten make a different variety of the lamellated kind, which is found of a green colour, sometimes on one side inclining to yellowish.

It is found in Norwegue, Zöblitz, &c.

The *Spanish chalk*, Germ. *Spanische Kreide*, *Steatites cretaceus* belongs to the Steaites. It stains, and is therefore used for writing on slates.—It becomes very hard in the fire.

To the harder kind belongs the *Briançonner earth*, the *Chinese smectis*, or *speckstone*, which takes a fine polish.

SPEC. II.

TALC TALCUM.

This is a fatty or greasy substance, which is found of various colours, viz. yellowish white, greenish, silver white, and flesh colour.

It is shining, and of various degrees of transparency; generally so soft, that impression may be made on it with the nail. It is found
solid,

solid, lamellated, scaly, and crystallised; it differs from mica which it resembles, in this that its lamellæ are not elastic, and it contains less siliceous earth; when exposed to heat, it becomes more brittle, does not effervesce with acids, and is composed of magnesian and siliceous earths, more or less, intimately combined, with a little argillaceous earth.

Mr. Werner divides the talc into the three following varieties:

VAR. 1. *Earthy Talc.*

This kind is of a greenish white colour, scaly, shining, compact, friable, stains the fingers a little, is greasy to the touch. It is found near Freiberg and Gera, in Saxony, and in Grönland

VAR. 2. *Common Talc.*

This kind is generally greenish and silver white, shining, has a lustre similar to mother of pearl, is semi-transparent, and soft, has a lamellated texture, is greasy to the touch.

It is found solid interspersed, and in thin hexagonal plates, or prismatic.

It is easily divided into thin laminæ, which are flexible.

It

It is found in serpentine, lapis olaris, and in steatite, near Querbach, Silberberg and Reichenstein in Silesia, near Merzberg, Zöblitz, in Tyrol, near Cleven in Veltlin, near Naples, and in Switzerland.

It yields by analysis, 50 silic. 45 magnesian, and 5 argill. earth.

VAR. 3. INDURATAD TALC. *Pot Stone.*

Waller. *Steatites opacus particul. micac. mixtus solid. &c.*

Lat. *Talcum proprium ollare.*

French. *Pierre ollaire.*

Swed. *Telosten.*

Dan. *Fedsteen.*

(Werner.) Germ. *Verhärteter Talk.*

It is generally of a pale yellowish and greenish grey, reddish grey, or white colour, and contains many micaceous particles; it is generally found compact, and so mixed that its component parts cannot be distinguished by the naked eye; it is shining, has a soapy glittering lustre; its texture is lamellar, and it breaks in orbicular shaped plates; it is a little semitransparent on the edges; it is brittle, and can hardly be impressed with the nail; is
too

too hard for writing, but is very fit to be cut into vessels of various shapes; it is not acted upon by water, and not readily by acids; it takes a fine polish, it resembles in appearance the frozen fat oils. Its specif. gravity is generally = 2700.

It becomes hard in the fire, and is therefore wrought into various vessels or utensils for boiling water, &c. it is also made into furnaces.

That from China is the best. It is found in nests near Zöblitz and Schwarzenberg in Saxony, and near Dorfbach in Silesia, in serpentine stone; in large beds in Norway, Finland, in Tyrol, and island Elba.

By analysis it has yielded 38,12 silic. 6,66 argill. 38,54 magnesian, 0,41 calcar. earth, 15,62 iron, and 0,41 fluoric acid.

The soft stone of *Grönland*, the gilt stone of *Canton Uri*, which is cut into plates, and said to last for ever, belongs to this species.

Also the cut stone, Germ. *Schneidestein*, of Tyrol mountain, in which the bar-shörl is found, is of this kind.

SPEC. III.

CHLORIT. *Talcum chlorites.*

VAR. 1. *Chlorit Earth.* Germ. *Samt-erde.*

This

This substance approaches the talc stones; it is of a mountain, leek and olive green colour, has a scaly texture, and a glittering appearance, is rather earthy to the touch; stains the fingers a little, is light, and discovers a little clay smell when breathed on. It yields by analysis 437 magnesian, 357 silic. 128 iron, 0,41 argill. and 0,62 calcar. earth.

It is found in Saxony at Gieshubel; in the primitive mountains, and is also found in rock crystal.

VAR. 2. CHLORIT SHISTUS.

Talcum chlorites Shistosus.

Germ. *Chlorit Schiefer.*

Its colour is the medium between greenish grey, and mountain green.

It is found solid, a little shivery, rather a fat lustre; its texture is shistous, sometimes undulated; it breaks in orbicular pieces; it gives a mountain green trace, is opaque, and a little harder than the foregoing variety; it is found between the argillaceous and micaceous shistus and indurated Talc; sometimes found mixed with quartz granit, and octoedra magnetic iron stone.

A very fine sort is found in Corsica and Tyrol.

VAR.

VAR. 3. COMMON CHLORIT of Werner.

This is of an olive and mountain green colour, sometimes blackish green; it is found solid and interspersed, also coathing quartz crystal; appears earthy in its fracture.

SPEC. IV.

SERPENTINE.

Talcum Serpentinus.

Waller. *Steatites Serpentinus.*

This stone is generally found deep blackish, olive green, seldom yellow, sometimes crimson red, blueish and greenish grey, generally one specimen exhibits various colours, like the skin of a serpent, which it resembles, and is therefore called serpentine.

It is found in solid masses, seldom interspersed, when broken it has a dull appearance, but takes a polish; it is smooth to the touch.

Its specif. gr. = 2400.

With the nail no impression can be made on it, but its surface can be scraped with a knife; it is cut into various vessels, as mortars, cups, &c.

In the fire it becomes harder, and alters its colour; it is only semitransparent on the edges, when in thin plates.

It

It forms large parts of certain rocks; it contains occasionally quartz, fhörl, calcareous spar, iron glimmer, mica, amianth, talc, lithomarge, arbest, lapis ollaus, and garnit.

It is found in Saxony, at Zöblitz, and near Chemnitz, &c.

It yields by analysis, 60 filic. 11,1 argill. 5 magnesian, and 5,7 calcar. earth, 4,7 iron; but the proportion varies accordingly. Perhaps the Variolit might be placed here?

SPEC. V.

NEPHRITE.

Lat. *Lapis Nephriticus.*

Hipstone. *Jade.*

French. *Jade.*

Germ. *Nierenstein*, so called because it was supposed to cure the pains of the kidneys.

This stone is the hardest of all this genus; its colour is greenish yellow, mountain and olive green, blackish green; it is semitransparent, has an appearance as if it had imbibed oil.

It is smooth or soapy to the touch; not readily acted upon by acids; it does not melt in the strongest fire; its texture is fine, and the fragments shivery.

Its

Its specif. gr. = 2600.

(That found by Mr. Hoepfner yielded by analysis, 47 filic. 4 argill. 38 magnesian, 2 calcar. earth, and 9 of iron.)

It is found in Egypt, China, in the Amazon river in America, in the mountain Altoi in Siberia, and on the Carpathian mountains.

The Pietra d'Egitto, by the Italian antiquarian, belongs to this kind, and the Punamustone from New Zealand, of which the antipodes had made planes, chissels, and other utensils, is also of this kind.

SPEC. VI.

LAPIS MURIATICUS.

Germ. *Bitterstein.*

Its colour is mountain green, partly inclining to milk blue; it is semitransparent, has a silk lustre, is very tough, takes a fine polish.

Its specif. gr. = 3350.

Is only found in mixed rocks in Corsica, and on the Alps.

SPEC. VII.

ASBEST, from the Greek, *Asbestos*, which signifies incombustible.

Talcum Asbestus.

R

This

This species includes the following varieties, which differ from each other in certain properties, and in appearance.

VAR. I. MOUNTAIN CORK. *Suber montanum*.

Talcum asbestus suberiformis.

French. *Liege fossile*.

Germ. *Bergkork*.

This is a very light substance, resembling cork; it is found of a light white, reddish white, yellowish grey, cream yellow, and yellowish brown colour; it is found compact; it has a fibrous texture; the fibres run in irregular directions; it is quite opaque, suffers impressions from the nail; when in thin pieces, it is somewhat flexible, elastic, has an arid appearance, generally so light, as to swim on water.

Its specif. gr. = 0,993, to 1,000.

It effervesces a little with acids, but is not soluble in them.

It yields by analysis, 62 filic. 2,8 argill. 22 magnes. 10 calcar. earth, and 3,2 iron.

It is found at Salberg in Sweden, and at Johann Georgenstadt in Saxony, containing often silver ores, as at Clausthal on the Harz, in Donnemore in Sweden, in Hungary, Carniola, &c.

Another

Another kind is called *Mountain Leather*; French, *Cuir fossile*; which is composed of broad flexible lamellar pieces resembling leather, and is still lighter.

Its specif. gr. = 680. It yields by analysis, 56, 2 silic. 2 argill. 26,1 magnesian, 12,7 calcar. earth, and 3 of iron. It is found in the *Olonezki Mountains*, on the *Oka*, in gypsum.

VAR. 2. AMIANT, *Mountain Flax*.

(*Ripe Asbet.*)

French. *Lin fossile*.

Germ. *Bergflachs*.

Lat. *Talcum asbestus amianthus*.

Born Catal. *Asbeste feuilletée*.

Gmel. *Asbestus amianthus*.

This substance is composed of long thin flexible fibres, or filaments, of a greenish, or silver white, yellowish or flesh, colour; it exhibits a silky lustre, sometimes resembling a metallic lustre; the fibres run sometimes parallel, sometimes curved; it is generally a little semitransparent; it is soft and rather fatty to the touch, and when rubbed it may be brought into a state resembling wool.

Its specif. gr. = 908; it melts *per se*, which is seen, when a few filaments are burnt in the flame of a candle; it dissolves in microcosmic salt, becoming afterwards by continued heat, a green glass, which melts in earthen crucibles, but acts upon them.

It yields by analysis, 64 filic. 2,7 argill. 17,2 magnes. earth, 2,2 iron, and 13 calcar. earth: A certain kind from Savoy yields by analysis, 64 filic. 3,3 argill. 18,6 magnes. 6,9 calcar. 6 baryt, and 1,2 iron.

It is frequently found with the asbestus and serpentine; a very fine sort is found in Candia, Cyprus, Corfica, in Siberia, China, in Silesia, near Zöblitz, and in the Savoy mountains. The Romans used to prepare this substance to make linen of it, and as it is incombustible, and purified by fire, they used it, to envelope the dead bodies which were to be burnt, in order thus to collect the ashes, and not to lose any thing of the remaining parts of the body.

It is now used for making paper, and also for wicks.

VAR. 3. COMMON ASBEST. (*Unripe Asbest.*)

Asbestus vulgaris.

Waller. *Asbestus durus lignos. fibris parall.*
&c.

Ital.

Ital. *Amiantho immaturo.*

Fr. *Asbest non mure.*

Its colour is greenish grey, yellowish leek, and olive green; it has hardly any lustre; it is composed of rigid stony fibres, which are a little flexible, sometimes curved or undulated, and exhibit generally cuneiform pieces.

It is a little smooth to the touch, partly resembling rotten wood; it is semitransparent on the edges; its surface can be scratched with a knife, sometimes it scratches glass; it is not readily acted upon by acids; it is not altered by fire, except that it becomes harder; it melts with borax and soda into a white vitreous mass.

Its specif. gr. is generally = 2500.

It is found frequently at Zöblitz in Saxony, Bareith, in Sweden, Siberia, Tyrol, &c.

It is found by analysis, to be composed of siliceous, argill. magnesian, and calcar. earth, and a little iron.

SPEC. VIII.

MOUNTAIN WOOD.

Talcum asbestus lignosus.

Germ. *Bergholz.*

Its colour resembles brown wood, sometimes inclining to yellowish; it is opaque, elastic, flexible; its texture is flaty, curved, and irregularly fibrous; it is only found at Clausen in Tyrol.

SPEC. IX.

RADIATED, or STRIATED SHOERL.

Germ. *Strahlstein, Strahlschörl.*

This substance is frequently confused and arranged with the real shörl; it is found mostly of a greenish colour, greyish, partly semitransparent, radiated, or in thin bars.

Mr. Werner mentions three varieties.

VAR. I. COMMON STRIATED STONE.

Germ. *Gemeiner Strahlstein.*

Talcum actinotus vulgaris.

Gmel. *Actinotus.*

Its colour is apple—mountain—leek-olive—and blackish-green, also reddish grey. It is found compact, in long flat 4 and 6 sided prismatic crystals, the prisms are disposed parallel, sometimes diverging, partly irregularly crossing each other; have a lustre, are brittle, not flexible.

flexible. The texture of the compact kind is radiated, stellated, and granulated.

The crystals are semitransparent, and longitudinally striated, and not greasy to the touch. A certain kind is found to have its colour from prasem, with which it is found. It is also found in feldspar, quartz, mica, steatite, serpentine, amianth, calcar. spar.

It constitutes often the matrix of certain metals, as of the iron—copper—and tin, ores.

It yields by analysis 43 filic. 22 calcar. earth, and 34 iron.

It is frequently found in Zitterthal, in Tyrol, in Swedish iron mines, in Saxony near Ehrenfriedersdorf, near Gieshübel, with copper, iron, zink, and lead ore; Hornblende and prasem, &c.

VAR. 2. VITREOUS STRIATED SHÖRL.

Germ. *Glasartiger Strahlstein.*

Talcum actinotus vitriforme.

Gmel. *Actinotus vitreus.*

It is of a silver and greenish white olive green colour; it is found in solid masses, and also crystallised, in needle-shaped, and longitudinally striated, long thin six-sided crystals, most-

ly coherent; it has a vitreous lustre, and is semitransparent.

Its specific gr. = 3,452.

The compact kind has a radiated or fibrous texture; it is very brittle, and not greasy to the touch; it is found near Allemont in Dauphiné; in Zitterthal in Tyrol; on the island Sky, in Scotland.

VAR. 3. ASBESTOUS STRIATED SHÖRL.

Germ. *Asbestartiger Strahlstein*.

Talcum actinotus asbestus.

Its colour is mountain green, greenish white; its lustre resembles mother of pearl; its texture is radiated; it is opaque, soft, and is frequently found on Fichtelberg in Bareith.

SPEC. X.

TREMOLIT. TREMOLITES.

It has a silver white colour, a silky lustre; is partly semitransparent, mostly diverging and barlyke, generally exhibiting cuneiform pieces, the particles crossing each other, in a diverging manner; it is brittle; its texture is fibrous, when its surface scratched with a needle in the dark, it yields phosphorescent sparks.

It

It effervesces a little with acids; it scratches glass; it is found in the valley Tremola, on St. Gotthards.

It yields by analysis 100 magnesian, 650 fili. 180 calcar. earth, 69 water and carbonic acid.

SPEC. XI.

SPUMA MARIS.

Gmel. *Talcum spuma maris.*

Germ. *Meerschaum.*

Fr. *Ecume de Mer.*

Its colour is white, and yellowish white; it has an arid appearance; is smooth to the touch, and soft; becomes a lustre when polished or cut; absorbs water; adheres to the tongue, and is very light; it is found in solid pieces.

It is used for tobacco pipes. The best kind is found in Kiltischik near Koni, in Anatolia, and North America.

It yields by analysis 54, 16 filic. 44, 66 magnesian earth.

GENUS

G E N U S VI.

CALCAREOUS EARTHS and STONES.

THE calcareous substances are found in the state of earths, indurated, compact, and in the state of stones; they partly originate from animal and vegetable substances, and partly from other substances, which had probably existed previous to animals and vegetables, and those of a prior formation are called primitive limestones.

Calcareous earth the chief component part of the substances, belonging to this genus, on account of its great affinity to other substances, is never found quite pure. The substances ranked under this head, contain generally other mineral—vegetable—or animal, substances; water, carbonic acid, inflammable substances, oxyd of metals, or other earths and stones, not yet alluded to; notwithstanding which, they retain characteristic properties, which distinguish them from

from the substances belonging to the other genera of earths and stones, and also from each other, laying a foundation for a division of them, into species and varieties.

The limestone, or compact calcareous earth, which forms mountains, may admit of three divisions.

1. That which is found in large beds, resting on the primitive granit, and which is called primitive limestone, containing flint, shöl, fieldspar, &c.

2. That which is found near primitive mountains, and which forms rocks, and contains no shells or cockles.

3. That which contains shells or cockles, and madrepors, &c.

The calcareous stones are never found so hard, as to strike fire with steel, or scratch glass; they can all be scratched or scraped with a knife; and some are quite friable, and stain the fingers.

Calcareous earth has in various states of purity and admixture, been wisely scattered over every part of the habitable globe; and is found useful to many purposes in common life.

The calcareous substances that have not undergone an intimate combination, or that have
not

not been altered by union with other substances, have a dry earthy appearance.

Those of a harder nature, exhibit when broken, an even, granular, seldom a radiated texture, or they have a sparry appearance, which approaches them to a cubical form, and have a lustre.

Of this kind some are transparent in different degrees, others are crystallised, or exhibit a regular shape.

All of them can be easily reduced to powder.

The softer and loose kinds absorb water, and have besides, a great affinity to carbonic acid, or fixed air, which causes them to effervesce with other acids.

Aerated calcareous stones, when exposed to a strong heat, are deprived of the carbonic acid, and lose the property of effervescing. They combine, or are saturated with heat, and so become soluble in water. During their solution in water, they part with a great quantity of absorbed heat, and thus again recover their affinity to carbonic acid, and their power of depriving other substances of it.

When pure or saturated with heat, they disengage ammonia, or volatile alkali, from sal ammoniacum, or muriate of ammonia.

They

They never melt per se, in the fire, nor do they harden in it.

They are soluble in nitric and muriatic acids, and form with them salts, which deliquesce, when exposed to the atmosphere. For the other chemical distinguishing properties of the calcareous earth, vide page 42. The different substances by which the state, appearance, and nature of calcareous earths is altered, are as follows.

1. The carbonic acid.
2. The boracic acid.
3. The sulphuric acid.
4. The fluoric acid.
5. The phosphoric acid.
6. Petroleum, or bitumen.

Many are mixed, or combined with other earths, and oxyd of metals, in different proportions, according to which, the following divisions have been made.

DIVISION I.

Calcareous substances containing carbonic acid.

The species belonging to this division, are soluble with effervescence, in nitric and muriatic acid; when exposed to a strong heat, they unite with a certain quantity of heat, which they give out again, when mixed with water, in which they

they are now soluble, and precipitate the solution of corrosive sublimate of an orange yellow colour.

When crystallised, their regular figure is supposed by certain mineralogists, to be derived from the parallelopiped; others suppose it to be prismatic.

They are not hard; they form selenite with sulphuric acid.

SPEC. I.

CHALK.

Lat. *Creta.*

Gmel. *Creta scriptoria.*

Waller. *Creta coherens solida.*

Cronst. *Creta solida friabilis.*

French. *Craie blanche.*

Germ. *Kreide.*

This is a stony substance, generally compact, seldom found in powder; it is white, or yellowish white, and opaque; may be marked or impressed by the nail; is used for marking or writing; it absorbs water, but dries soon after, and is therefore used by chymists for filtering, or for separating the moisture of fine precipitates. It is found in solid masses of an earthy appearance, without any lustre; adheres to the tongue,

tongue, feels rather rough between the fingers; effervesces strongly with acids.

It contains generally 40 per cent. carbonic acid; it is found containing flints, and other substances, in large strata, particularly on certain sea coasts as in England, Sweden, Germany, and other parts of the world.

SPEC. II.

LIME-STONE.

Lat. *Lapis calcareus*.

This species differs from the foregoing, by higher degree of hardness, and by its containing various heterogeneous substances.

VAR. I. COMPACT LIME-STONE.

Fr. *Pierre a chaux compacte*.

Germ. *Dichter Kalchstein*.

Hung. *Meszkö*.

Swed. *Fät Kalkstein*.

a. COMMON LIME-STONE.

Its colour is greyish or yellowish, blueish grey, smoke-grey, seldom of flesh colour, cream yellow and blackish, often exhibiting various

various colours mixed ; it has a dull appearance ; the harder kind takes a polish, and is called marble.

It forms large chains of rocks, gangues, most generally stratified, or flötz mountains, and contains animal petrefactions.

It originates from a precipitation of the sea water.

b. OOLITHUS.

Germ. *Rogenstein.*

Lat. *Calcareus marmor oolithus.*

Fr. *Oolithe, Pierre ovaire.*

Hung. *Tojás—Kö.*

This stone is composed of a number of grains of compact lime-stone, cemented by a clayish substance, is generally of a dark yellowish grey and brown colour, generally both colours are met with in one specimen, so that the grains are brown, and the other intermixed mass, or the cement is grey ; the grains are found from the size of a pea, down to the size of a mustard seed.

It is found forming whole flötz mountains, near Eisleben, Thuringia, &c.

Some authors suppose it to be petrified fish eggs.

It

It generally contains 90 parts calcareous, 10 argillaceous earth, and 1 iron.

VAR 2. LAMELLATED LIME-STONE.

Germ. *Kalkschiefer, blättricher Kalchstein.*

Calcareus marmor lamellosum.

a. *Of a granular texture.*

Granular Lime-stone.

Its colour is light, yellowish, greenish, greyish, white, seldom yellow, blueish, grey, and black.

It is found in compact masses; when broken, is a little shining, and has a lamellar grained texture.

It exhibits sometimes dendritical figures, and impressions of marine animals of the later creation.

It is found near primitive mountains, in layers of gneiss, micaceous, and argillaceous shistus.

Q

SPEC.

SPEC. III.

TOFUS.

Germ. *Kalksinter.*Swed. *Sinter.*

This stone has been deposited from lime water in the cavities of the lime flötz mountains, and in several hot wells. It is found of various colour, of different degrees of hardness, and of a fine texture. The texture is found radiated or fibrous, spatous and compact, according to its different appearances, or shapes, it may be brought under certain divisions.

VAR. I. STALACTITICAL LIME-STONE.

*Calcareus Stalactites.*Germ. *Tropfstein.*

This kind is found in the cavities of mountains, of a stalactitical, or other particular shape.

This stone has been formed by the gradual deposition and evaporation of water, impregnated with lime, which has been more or less inspissated or hardened by the air; and according to certain circumstances, it exhibits stalactitical

titical figures, such as the, improperly called, *flores ferri*; which, when transversally broken, has a stellated texture.

The *Baumannshöhle* on Harz, is remarkable for such products, where stalactites of this kind are found of 10 inches in diameter, and sometimes of a tubular form. This kind is sometimes a little semitransparent, and glittering, according to the different quantity of water and carbonic acid which it contains. Sometimes the mass runs into cavities, and fills them, and becomes on drying more or less compact. This kind is used by statuaries for various purposes.

It is sometimes found coating roots of trees, which in time moulder away; they are called *osteocolla*. Sometimes it enwraps or involves different parts of plants or parts of animals.

To the incrustating kinds belong the globular incrustations, as the *Oolites* and *Pisolithes*, which are formed in the Carlsbad, containing sand corns, inclosed; and the so called *sprudel stone*, or *sputtering stone*, from Carlsbad, which exhibits various colours and figures.

At Gibraltar it is found filling up certain cavities containing bones, and cementing the *osteolithe*, &c. with this kind may be ranked the

alabaſtre antico, and *confetto di Tivoli*, reſembling ſometimes candied ſugar figures.

SPEC. IV.

CALCAREOUS SPAR.

Cronſt. *Spathum calcareum et druficum*.

Fr. *Spath calcaire*.

Germ. *Kalch ſpath*.

This ſpecies of calcareous ſtone, united to carbonic acid, differ from the foregoing ſpecies and varieties. It is purer than the other; it is found of different degrees of transparency; it has a lamellar texture, and breaks in parallel rhomboidal plates; its ſurface is more or leſs ſhining; and is beſides found cryſtallified, or of regular ſhape.

It is found of various colours.

When expoſed to heat, it parts with its transparency, and carbonic acid. It is generally compoſed of 55 parts of calcar. earth, 34 carbonic acid, and 11 of water; and its ſpecif. gr. = 2715. It is found in ſtratiſied or flötz mountains.

The following varieties are diſtinguiſhed, reſpecting their colour.

White,

White, found on the Harz, and various other places.

Greyish black, at Schneeberg, near Freiberg, &c.

Amber colour, in Bohemia, at Ratiborschitz, Idria, &c.

Greenish, near Freiberg, and upper Laufatia.

Olive green, near Schemnitz, in lower Hungary.

Purple, at Andreasberg.

Yellow, on Harz, in Kärnthen, Derbyshire, and East India.

Honey colour, at Zellerfeld on Harz.

Flesh colour, at Adelfors in Sweden.

Rose colour, at Andreasberg.

The following varieties or modifications are known, with respect to figure.

Pyramidical.

Simple Pyramids.

1. Perfect.

a. Six sided pyramids, with equal angles and sides, viz. the dog tooth spar.

b. ——— two and two faces meeting under an obtuse angle.

Q 3

Double

Double Pyramids.

c. The side faces of the one obliquely placed upon the other.

d. Three and three side faces meeting under an obtuse angle.

e. The crystals of *a* and *b* adhering.

2. The angles of the basis truncated.

a. The six sided simple pyramid with the angles of the basis truncated.

b. The double six sided pyramid, and the side faces of the one proceeding from the side faces of the other.

3. The ends acuminated by three faces.

a. The simple two sided pyramid acuminated by three convex faces.

b. The double six sided pyramid, the side faces of the one proceeding from those of the other, having the angles of their common basis truncated.

4. Simple pyramids in an inverted position.

a. Six sided pyramid, the end face acuminated by three faces, which proceed from the alternate side faces.

b. The six sided pyramid, with a druse end face.

5. Of six sided prismatic figure.

a. The

a. The six sided prism acuminate on both ends by six faces; the side faces of which proceed from the side edges of the prism. The faces of the accumulation exhibit rhomboid faces, and the side faces longish hexagons.

b. The same; but each pyramid terminated again by three faces; the faces of which proceed from the alternate side edges of the first pyramid; in short, doubly acuminate on both ends.

c. The six sided prism obtusely acuminate on both ends, by three faces, proceeding from the alternate side faces of the prism, and the sides of the other accumulation, proceed from the side faces of the prism, which were left free from the accumulation of the other end; all the faces of these crystals exhibit pentagons.

d. The six sided prism acuminate by three faces like the foregoing, but truncated.

e. The perfect six sided prism.

f. The perfect six sided plate.

6. Of three sided pyramidal figure.

a. The lenticular.

b. The saddle shaped lenticular.

Q 4

c. The

c. The three sided pyramid, flat, double, and the angles of the basis truncated.

d. The perfect three sided pyramid, flat and double.

e. The rhomb, or the rhomboidal octodron.

f. The cubical.

g. The acute, angular, three sided double pyramid.

h. The same, but hollow.

i. The acute, angular, three sided pyramid, hollow.

To the rhomboidal kind belongs the double spar from Iceland, Fr. *Spath d'Islande*, Germ. *Doppel Spath*.

This kind represents objects double, sometimes triple; when looked through, we find it to be owing to the lamellated texture.

Its acute angle describes about 77 degrees, and the obtuse, 112.

SPEC. V.

BROWN SPAR.

Germ. *Brown Spath*.

Calcareus Spathum Crunescens.

Its colour is generally milk white, flesh, and rose colour, greyish, yellowish, and reddish

dish white; when exposed for some time to air, it becomes brownish; it is generally opaque, seldom transparent; its texture is lamellated, resembling heavy spar, or spatous ironstone; it is a little harder than calcar. spar; it only effervesces with nitric acid when reduced to powder; it is found solid, very seldom kidney shaped; but frequently crystallised, viz. 1. Lenticular. 2. Rhomboid. And in hollow, acute—angular—six sided pyramids.

It yields by analysis, 50 parts calcar. 22 iron, 28 manganese. The greatest quantity is found near Freiberg, Schneeberg, and Anna-berg.

SPEC. VI.

PLATED SPAR.

Germ. *Schieferspath.*

Fr. *Spath Shisteux.*

Swed. *Skifwer Spath.*

It is found of a greyish, and reddish white colour, has a lustre, similar to mother of pearls; is a little semitransparent, has a curved lamellated texture, is soft, effervesces strongly with nitric acid; it is found solid, and coarsely interspersed,

terfperfed, is brittle; it is found particularly near Schwarzenberg in Erzgebürge.

SPEC. VII.

PEARL SPAR.

French. *Spath perlé.*

Germ. *Perl fpath.*

This fubftance is white, yellowifh and red-difh, femitransparent, and has a pearl luftre.

It yields by analyfis, 60 aerated calcareous earth, or carbonate of lime, 35 magnesian earth, and 0,3 of iron.

It is a little harder than the common calcareous fpar.

Its fpecif. gr. = 28,37.

It is found cryftallifed in rhombs, the acute angle of the faces describe 77 or 78, and the obtufe 102 or 103.

It refembles the double fpar.

It is found in the mines of St. Marie, in Bavaria, and on the Harz.

SPEC. VIII.

STELLATED SPAR.

Germ. *Sternfpath.*

Mr. Fitchal found it in the limestone of the Carpathian mountains.

It

It effervesces with acids.

According to Bindheim, it yields by analysis,
66 calcar. 30 filic. earth, and 0,3 iron.

SPEC. IX.

MARL.

Germ. *Mergel.*

Lat. *Calcareus marga.*

French. *Marne.*

This species includes those kind of aerated calcareous substances, which are mixed with a considerable portion of clay, sand, mica, sometimes magnesia, or of several of these together; some kinds are also penetrated with bitumen; it seems to originate from the deposition of river and sea water; it is not so compact as the marble, and does not take a polish; it has its colour generally from iron; it effervesces with nitric acid, and is, for the greatest part, soluble in it.

It is found in the beds of rivers, on hills, and in flat countries subject to inundation.

Marl yields several varieties, according to its different state and composition.

VAR.

VAR. I. EARTHY MARL, LOOSE MARL:

Lat. *Calcareous marga friabilis.*French. *Marne terreuse.*Swed. *Mergel—Lera.*Hun. *Tsapo—Föld.*

Its colour is yellowish white, or yellowish grey; it has an arid appearance, is earthy to the touch and soft; effervesces with acids, softens in water, and forms a paste, not adhesive when exposed to heat; it is found in certain calcareous flötz-mountains, viz. in the principality of Mansfeld and Sangerhausen, is chiefly composed of lime and clay; it is employed to improve the soil.

VAR. 2. MERGEL TUFF.

This substance is found frequently in the flat alluvial mountains, generally exhibiting traces of vegetables, which had formerly been incrustated, particularly impressions of leaves and roots, &c. sometimes represents the smaller kind of water snails; it is remarkable, as it forms frequently the matrix, or the beds in which the fossils of elephants, rhinoceros, turtle, and other India animals, which are now found frequently in Germany.

VAR.

VAR. 3. INDURATED AND COMPACT MARL.

Germ. *Verhärteter Mergel, or Mergel-*
stein.

French. *Marne pierreuse.*

Lat. *Calcareus marga indurata.*

Its colour is generally grey; it has a dull appearance; its texture is compact, earthy, and sometimes shivery; it is opaque; some kind take a little polish; certain kinds are called in Germany *Zechstein*; other kinds bear various provincial names, according to the various purposes to which they are employed. It is found only in flötz-mountains.

With the indurated marl, may also be ranked, the stones called *ingwerstein*, also the aetites or the eagle-stone; also that remarkable stone called *ludus helmontii*, or waxenstein, which is only found in a few places, viz. near Ansfers, and in Franconia.

VAR. 4. MARL SHISTUS.

This kind of stone contains very fine dendritical vegetations, which is found at Iberg, on the Harz. To this belongs also the *ruin-marble*,
pæfino,

pæfino, and cittadino, from Florence. A similar beautiful kind is found in Tyrol.

DIVISION II.

This includes such calcareous stones, as consist of the same component parts as the marl, but which are mixed with bituminous substances.

SPEC. X.

BITUMINOUS MARL SHISTUS, also improperly called *Slaty Copper Ore*.

Germ. *Bituminöser Mergel Schiefer.*

Lat. *Calcareus ardesia margatia.*

Gmel. *Marga Bituminosa.*

Waller. *Cuprum corrosum vel diversæ mode mineralisatum, shisto inherens.*

French. *Ardoise ouivreuse.*

Swed. *Koppar Schifwer.*

Hung. *Tàblàs, Rètes, Rèz.*

Its colour is greyish black, blueish, and brownish black; has a fatty glittering appearance; has a slaty texture, effervesces a little with acids, is sonorous, when in thin plates, and

is

is opaque; it is earthy to the touch, and more or less penetrated with bitumen; contains sometimes ores, particularly copper ore; also often impressions of organized bodies of the later creation; it forms the flötz-mountains throughout Thuringia and Mansfeld, resting upon sand-stone, which constitute the lower part of the lime flötz; it contains the vitrious and variegated copper ore, but most generally copper pyrites. It contains sometimes three or four pounds of copper in a hundred; its most characteristical mark is, that it frequently contains impressions of fishes and sea plants.

SPEC. XI.

SWINE-STONE.

Germ. *Stinckstein.*

Lat. *Calcareus suillus.*

Cronst. *Terra calcarea Phlogisto mista,*
&c.

French. *Pierre puante.*

Swed. *Orsten.*

Its colour is generally yellowish brown, black, cream yellow, and yellowish grey, has partly

partly a dull, partly a glittering appearance; when broken, it exhibits a shivery or conchoidal surface, is opaque and compact; its surface can be scraped with a knife, during which it emits a urinous smell; it is found in flötz mountains in various shapes, sometimes sparry, or in the state of marble; contains often remains of animal parts; it is composed of calcareous earth and petroleum.

DIVISION III.

Calcareous earth united to phosphoric acid.

SPEC. XII.

APATITE, APATITES.

Calcareus Apatites.

This substance was first discovered by Werner.

It has its name from the Greek language, in which *appatao* signifies *deceive*, because this stone was for a long time mistaken for another, from its appearance; its colour is various, viz. mountain—asparagus—leak green, inclining to olive green, blueish, yellowish, and chocolate brown; this stone has hitherto only been found crystallised, viz. in
three

three and six sided prisms, in six and eight sided plates, variously modified. The prisms are found of various sizes, sometimes above an inch long, and near an inch in diameter. These figures seem to derive from the parallelopiped. It is shining, and rather of a greasy lustre; has a lamellated texture, is semitransparent, and its surface can only be scratched with a knife.

Its specif. gr. = 3,218.

It does not melt by the blow-pipe, but loses its colour; it is but gradually dissolved in nitric acid.

It yields by analysis 55, calcar. 45 phosphoric acid. It is found near Ehrenfriedersdorf, generally accompanied with quartz and fluor, lythomarge, smectis, arsenical—pyrites, wolfram, seldom molybdena and topaz.

SPEC. XII.

PHOSPHORATED LIME-STONE.

Its colour is yellowish white, or opaque; when broken, its surface appears earthy; it is heavy, and not very hard; when scratched with a knife in the dark, it becomes phosphorescent; and when put upon red hot charcoal, it emits a green phosphorescent light like the

R

apatite;

apatite; it is found in Estremadura, with alternate strata of solid quartz.

DIVISION IV.

Calcareous earth united with Boracic acid.

SPEC. XIII.

BORACIT.

Calcareous Boracites.

This remarkable mineral is restricted to the Hanoverian territories, where it is found in a lime rock, or gyps flötz near Luneburg; its colour is generally greyish white, more or less semitransparent, has mostly a vitreous appearance; it has only been found crystallised, in cubes, with truncated edges and angles, so that the faces of the truncated angles, exhibit alternately, hexagons and triangles.

The crystal exhibiting 26 faces.

Its specif. gr. = equal to 2,566.

It yields by analysis according to Westrumb, 68 boracic acid, 11 calcar. 13,5 magnesian, 2 silic. 1 argill. earth, and 0,7 iron.

DIVISION V.

Calcareous earth united to fluoric acid.

SPEC.

SPEC. XIV.

FLUORS.

Germ. *Fluss spathe.*

The fluor contains occasionally muriatic acid, filex, argillaceous earth, and inflammable matter. It does not effervesce with acids; its surface can only be scratched with a knife, and is a little greasy; it generally crackles and phosphoresces, when exposed to heat, except the colourless ones, which become electric when rubbed, and the coloured kind lose their colour in fire, but when exposed to a strong heat, it melts *per se*, and its fusibility is increased by the addition of a little calcar.—or argill.—earth, but it does not combine nor melt with filex. It melts with borax without effervescence; it is very seldom found in the state of earth, most generally compact or crystallised in cubes; it is often accompanied with calcareous spar; it is generally more or less transparent, and exhibits various colours; it is harder than calcareous and heavy spar, it is lighter than the latter, and heavier than the first, and much heavier than the selenite; it never strikes fire with steel.—The sulphuric acid expels, by the assistance of heat, the fluoric acid, which has the peculiar property of dissolving glass.

R 2

Its

Its specif. gr. is generally = 3,144, sometimes a little more.

On account of its being of a fusible nature, and its sparry appearance, it has obtained that name.

The fluor is found in gangues of ores; it never forms whole strata or beds, but generally veins or crystallised groups.

VAR. 1. FLUOR EARTH.

Lat. *Fluor Terreus.*

Germ. *Fluss Erde.*

Its colour is generally greenish and greyish white. It has sometimes the consistency of chalk; when exposed to a gentle heat, it exhibits a greenish phosphorescent light; some kinds exhibit various colours. It is found in the districts Marmoros in Hungary, and in Andalusia, between two beds of quartz, and in the neighbourhood of Iron-stone.

It contains calcar. earth, fluoric, and phosphoric acid.

VAR. 2. SOLID OR COMPACT FLUOR.

Germ. *Dichter or Derber Fluss.*

French. *Fluor solide.*

Lat.

Latin. *Fluor densus calcareous.*

Ital. *Vetro fluore.*

Its colour is generally verdigrease, greyish white, and purple; it is semitransparent, and has an even and glittering texture; is only found without particular shape, near Stollberg, and Strosberg on Harz, and in England, particularly the purple coloured.

VAR. 3. SPARRY FLUOR.

Lat. *Fluor calcareus spatiosus.*

Germ. *Fluspath.*

French. *Spath fusible.*

Waller. *Fluor mineralis crystallifatus.*

This kind is distinguished from the foregoing varieties, by its exhibiting always a regular shape. It is found colourless; of a light and greenish white, smoke grey, purple sky-blue, asparagus—leek—and olive green colour; it is also found of a fine amber,—seldom of a crimson red, colour; its principal figure is that of a cube, sometimes truncated on the angles or edges, very seldom octoedrical or prismatic; it is more or less transparent, and takes a fine polish; its surface is smooth; its texture curved; it breaks in three, or four sided pyrami-

dical fragments ; it contains generally 75 calcar. earth, 16 fluoric acid, and 27 water. Very fine specimens of it are found in Derbyshire, and frequently in Saxony near Freiberg, and in various other places.

The common kind of fluor is used in glass manufactories, and as a flux for certain ores or stones. The finer kind, which takes a fine polish, is manufactured into various statues, figures, and vessels.

DIVISION VI.

Calcareous earth united to sulphuric acid.

SPEC. XIV.

SELENITE, or GYPSUM.

Lat. *Selenites.*

Germ. *Gyps.*

Ital. *Gesso.*

French. *Gypse.*

Sulphate of Lime.

This mineral which is composed of calcareous earth, water, and sulphuric, or vitriolic, acid, is found in most parts of the earth, and in most waters.

It resembles somewhat the calcareous spar, in appearance ; it is found in solid masses, of particular

particular form, and frequently of a regular shape, or crystallised, has a lamellated, and sometimes, a fibrous texture; it is only soluble in 500 parts of water; it is opaque, and semi-transparent; it does not effervesce with acids, but is rendered soluble in nitric acid, by heat. When exposed to heat, it crackles and loses its water, becomes opaque, and very brittle, and when afterwards mixed with water, becomes hot, but not so much so, as the common calcareous stones. After being burnt, it absorbs water, and makes good mortar.

It is less hard than the marbles, and takes no polish. Its specific gravity differs, but is generally found $= 1870$ a 2320 .

By means of the blow pipe, it dissolves with ebullition, in borax, and sal microcosmicum.

It phosphoresces a little when exposed to heat.

It is not altered by air; is soft to the touch, and is found of various colours, white, reddish, yellow and brownish.

Its primitive figure seems to be the rhomboidal dodecaedron, or the rhomboidal octaedron, with the two points of the pyramids truncated: Or otherwise described; it exhibits two short four sided pyramids, having the basis rhomboidal, with the angles of 52° and 128° .

R 4

It

It seems to originate from the sulphuric acid vapour having combined with the calcareous earth, in various parts of the earth; or the calcareous earth has been separated from its other combinations, by the sulphuric acid, to which it has a stronger affinity than to most other mineral products.

VAR. 1. GYPSEOUS EARTH. FARINA FOSSILIS.

Germ. *Gyps erde*, or *Gyps mehl*.

Cronst. *Terra gypsea pulverulenta*.

This is a white, friable, loose, powdery, substance, which originates from crystallised selenite. It feels sandy between the teeth, effervesces a little with nitric acid; becomes very white when exposed to heat. It is very light.

It is found in the cliffs or fissures of gypsum rocks. It is said to be an excellent substance for promoting the growth of certain plants, when mixed with the earth in which those plants are designed to grow.

VAR. 2. ALABASTER.

Germ. *Dichter gyps*.

Fr. *Alabâtre*.

Calcareus gypsum solidum.

This

This stone bears some resemblance to marble, and exhibits various colours; is sometimes spotted; sometimes intersected with veins, or variegated with colours; it does not effervesce with acids; it is softer than marble, and does not therefore take a good polish; it can be cut with a knife; its texture is shivery and glittering; it is found of a yellow, greenish, reddish white, and blackish colour. Its specif. gr. is = 1872. It is composed of 32 parts of calcareous earth, 30 of sulphuric acid, and 38 water.

It is found solid in flötz mountains; in Russia, Spain, Tuscany, Sicily, and in various other places.

VAR. 3. LAMELLATED GYPSUM.

Germ. *Blättriger Gyps.*

Fr. *Gyps feuilleté.*

Lat. *Calcareus gypsum lamellosum.*

Wall. *Gypsum lamellare, &c.*

Its colour is yellowish grey, blackish honey colour, and flesh colour. It is found solid and interspersed, and in lenticular crystals; it is strong, shining, has a curved lamellated texture; is friable like loose sand-stone; sometimes

times it is mixed with quartz, when it strikes fire with steel.

It is found in flötz mountains. It constitutes the matrix of various stones, as well as of the boracit. It contains occasionally calcareous spar, as in Arragonia, in Gallicia, the so called hyacinths of Compostella, and also quartz crystals. It never contains petrefactions; when penetrated with bitumen, it is called *liver-stone*.

VAR. 4. FIBROUS GYPSUM.

Germ. *Fafriger Gyps*.

Calcareus Gypsum fibrosum.

Fr. *Gypse-strié*.

Swed. *Strälgips*.

Lapis inolithus stirium. *Strablgyps of Blumenbach*.

It is found yellowish, greyish, reddish, and of honey colour; it is found in solid masses, little shining; its texture is fibrous, filamentous, and radiated; it is generally a little semitransparent; it is generally accompanied by the other gypsum, and is found frequently near Dürreberg, near Merseberg, and in Jena, in great quantities.

SPEC.

SPEC. II.

SELENITIC-SPAR.

Germ. *Frauneneis*.

Calcareus selenites.

Fr. *Selenite*.

Ital. *Scagliola*.

This mineral is found colourless, yellow, smoky grey, and brown.

It is generally found solid, and sometimes crystallised in six sided pyramids; in four, six, and eight sided prisms, and also lenticular, and in rhomboidal plates; it breaks in rhomboidal pieces, is shining, semitransparent, in different degrees; is soft and a little flexible, sometimes exhibits a metallic lustre.

It contains the purest gypsum earth. It is found with copper pyrites, grey copper ores, and Galena in Bohemia, &c.

It is used for pastel-colour, and for cleaning silver vessels.

It forms flötz mountains; but is seldom found in ganges.

ADDI-

ADDITION to the CALCAREOUS STONES.

MARBLES.

The stones which are comprehended under the above denomination, are of a calcareous nature, and effervesce with nitric and muriatic acid; they are somewhat harder than limestones, more compact, of a closer grain, and are susceptible of a good polish. The specific gravity of these stones, is generally from 2,7 to 2,8; their texture, like that of limestones, is either lamellar or granular, and their colours various, not only in different masses, but in the same pieces. When the different species of which they are composed, are in large distinct masses, they are called *Breccias*; marbles of three colours, grey, yellow, and black, which abound in petrefactions, are called *lumachellæ*; most of the marbles are denominated according to their appearance. The white marble of Carara is the purest we are acquainted with; it has a granular texture, and like sugar, exhibits a glittering fracture, when just broken.

There are black, grey, blue and green marbles, which seem to be of the same nature, and contain a very small proportion of extraneous

ous

ous substances, less than any of the other kinds of marble.

Varieties of marbles stones.

White greyish marble. *Bardillio di Carrara.*

Reddish marble. *Rosso di Montieri.*

Flesh coloured marble. *Rosso di Caldonea.*

Red marble, inclining towards yellow.
Rosso di Sorbi.

Red marble, inclining towards yellow.
Rossato di pistoja.

Red marble, inclining towards brown.
Rosso di Viterbi.

Brown red marble. *Rosso di Conti.*

Yellow red marble, with deep red zones.
Lineato della Sieci.

Grey bluish marble. *Bardillio di Carrara.*

Yellow greenish marble.
Verde giallo della Quereiola.

Yellow greyish marble. *Biggio di Rovezano.*

Yellow brown marble. *Giallo di Borselli.*

Yellow

Yellow marble, lighter. *Giallo della Cecina.*

Marble of a yellow greyish colour.

Grigiato di Pratolino.

Greenish marble. *Verde del Onbrone.*

Light grey marble. *Biggio di Poppi.*

Deep grey marble. *Biggio di Ortaccio.*

Reddish grey marble. *Biggio di Conpioppi.*

Deep black marble. *Paraone di Fiandra.*

Lighter black marble. *Nero di Pistoja.*

Various coloured marbles.

White marble, spotted with pale red, and black points. *Pochanaja di Carrara.*

White marble, spotted with brown veins. *Breccia d'Egitto.*

White yellowish marble, spotted with red. *Breccia della Colonine.*

White marble, spotted with grey. *Bianco di Carrara.*

White

White yellowish marble, spotted with little
grey points. *Castra cane della Castellina.*

Red and white marble. *Rosso di Francia.*

Red, brown, and white marble.

Breccia di Maremma.

Red, white, and yellow marble.

Breccia della Rufina.

White and black marble.

Nero e Bianco antico.

Grey and yellow marble. *Gigiato di Siena.*

Marble spotted with white and pale red.

Rosato di Maremma.

Yellow, white, and red marble.

Brocatello di Maremma.

Red and white marble, with semitransparent,
spatous spots. *Lumachella di Serravilla.*

Grey, yellow, and brown marble.

Mistio di Mossimano.

Grey marble, with whitish spots.

Breccia di Vicentino.

Yellow marble, spotted with white, with
blackish points. *Perato della Grassina.*

Blueish and white marble.

Cipolino di Falgano.

White

White marble, spotted with green.

Verde di Monte Rufoli.

White marble, with deep red, or purpled spots.

Diaspro di Bargea.

Marble, spotted with green and brown.

Verde del Mulinaccio.

Marble with red spots, cinnabar colour, deep red and white.

Breccia di Pietra Santa.

Marble spotted with light red, white, and black.

Rosato di Volterra.

Marble with red, white, yellow, and black spots.

Breccia di Massumano.

Purpled red marble, yellow and white.

Brocatello di Spayna.

Marble with purple coloured or grey spots.

Perfichino di Seraveza.

Red and brown marble.

Rosso di Monte Catini.

Marble spotted with light red, brown and white.

Rosso di Rimandrio.

White, grey, and red marble.

Rosso di Monte Quercioli.

Red,

- Red, brown, and yellow marble.
Paonazo di Sales.
- Red, white, brown, and yellow marble.
Pinochiato antico.
- Red, grey, white, and black marble.
Porta Santa di Campillia.
- Deep red, grey, and white marble.
Mistio di Serravalle.
- Yellow, grey, and black marble.
Giallo e Nero di Siena.
- White, transparent, red, and grey marble.
Mistio di Modena.
- White, cinnabar red, and black marble.
Africano Rosato Antico.
- Yellow, white, and grey marble.
Mistio di Seraveza.
- Yellow marble, spotted with black.
Tigrato di Munione.
- Yellow, white, red, and grey marble.
Diaspro di Sicilia.
- Yellow, grey, and white marble.
Breccia di Pisa.
- Yellow, brown, and white marble.
Giallo Antico.
- Brown and white marble. *Perato di Sicilia.*
- Grey and brown marble. *Perato di Munione.*

Yellow and brown marble, with spots of transparent calcareous spath. *Giallo di Spagna.*

Red, brown, black, and white marble.

Rosso di Trapani.

Grey, red, black, and white marble.

Minerale di Castillione.

Green and red marble.

Perficchino della Grassina.

Red, black, and yellow marble, with semi-transparent spots. *Alabastro pecorello.*

Black, brown, and white marble.

Breccia de Margueritta.

Black, red, and white marble.

Granito d'Africano.

Marble with large black, white, and brown spots. *Porta Santa di Roma.*

Black, yellow, and grey marble.

Nero polveroso.

Black, white, and yellow marble.

Nero e Bianco di Porto Ferrajo.

Black, red, white, and grey marble.

Diaspro di Valombrosa.

Marble with white and black stripes.

Bardillio di Seraveza.

Black,

Black, grey, and white marble.

Nero e Bianco di Verona.

Black and white marble, with red veins.

Nero di Ancona.

Black, grey, and yellow marble.

Nero e giallo di Porto Venere.

Black, green, and white marble.

Verde di Germania.

Black, green, and white marble.

Breccia di Siena.

Figured marbles.

GENUS VII.

BARYTIC GENUS.

THIS Genus includes such stones as are principally composed of baryt or ponderous earth.

The basis of these stones, (the barytic earth) is never found in a separate or pure state ; it is found united with carbonic acid, (or fixed air) or with sulphuric acid, or is mixed to other earths and stones.

This earth has a stronger affinity to sulphuric acid, than any other earth, and can therefore decompose the combinations of other earths, with that acid. It can be separated from the carbonic acid by heat, or by dissolving it in nitric or muriatic acid, and then precipitating the baryt from the acid it is united with, by potash or soda.

When united to sulphuric acid, a decomposition may be produced by potash, if heat be applied.

The

The chemical distinguishing properties of this earth, are recited in the first part of the work.

The stones of this genus, are generally of a hard nature; they can however be scratched with a hard knife, but never strike fire with steel.

The barytic stones crackle when exposed to heat, and phosphoresce a little. They are also distinguished by their gravity, in which they exceed all other stones.

The following species and varieties are known.

DIVISION I.

Baryt united with carbonic acid, or fixed air.

SPEC. I.

CARBONATE OF BARYT.

VAR. I. PONDEROUS EARTH, *united with carbonic acid.*

Lat. *Terra ponderosa aerata, or Barytes aeratus.*

Germ. *Witherit*, so called by Werner, or
Luft saure Schweererde.

Fr. *Terre pesante aérée.*

This kind effervesces with diluted nitric and muriatic acid, and is entirely dissolved by them.

If exposed to a strong heat, it parts with the carbonic acid, and combines with heat, when it becomes like lime, in some degree, soluble in water.

Its specif. gravity = 4271.

Its surface can be scratched, and sometimes scraped, with a knife.

Its texture is shining, radiated, fibrous. It is brittle, and semitransparent, in a slight degree.

It is found in solid masses, and crystallised. When of regular shape, it exhibits six sided prisms, terminating in six sided pyramids, formed by the double truncation of the side faces.

It is found at Anglezark, near Chorley, in Lancashire; it is composed of baryt, carbonic acid, calcareous earth, and a little water.

DIVISION II.

The Baryt united to sulphuric acid.

SPEC.

SPEC. II.

SULPHATE OF BARYT.

Fr. *Terre pesante vitriolée.*Cronst. *Marmor metallicum.*Born. *Baryte vitriolée.*

This kind is heavier than the felenites, and other stones; it is more than four times heavier than distilled water; is not acted upon by any acid, except the sulphuric, when in a state of ebullition; when exposed to heat, and to the sun, it obtains the property of absorbing light, which it gives out again in the dark; it is almost unalterable in the fire, *per se*; it can only be decomposed by potash, or charcoal, by means of heat; it is generally intersected with metallic veins; it is found in solid masses, crystallised, approaching to an earthy state, and the transparent kind is electric.

The following varieties are known.

VAR. I. PONDEROUS EARTH CAWK, or *Friable heavy-Spar.*

Germ. *Schweerspath-Erde.*

Its colour is yellowish grey, yellowish and reddish white, resembling somewhat the tri-

poli. It has an arid appearance; it is friable, sometimes a little glittering; it soils the fingers a little.

It is found in compact heavy spar, near Freiberg; in Stafford, and Derby, and in the vicinity of Paris.

It contains sometimes a little gypsum, flex, and lime.

VAR. 2. COMPACT HEAVY SPAR.

Ponderosus vitriolatus compactus vel solidus.

Germ. *Dichter Schwerspath.*

It exhibits various colours, smoke grey, yellowish white, cream yellow, pale flesh colour; its form is sometimes kidney like, with impressions. When broken it has a dull appearance, seldom glittering, or shining, hardly semitransparent, mostly opaque; its texture is shivery, approaching to lamellar; it breaks in sharp angular pieces. It is composed of 83,5 sulphate of baryt, 6,7 flex, 2 selenite, and 2 water. It is found in the mine called Isaac, near Freiberg; in the lead mines of Derbyshire, and Staffordshire, &c.

VAR. 3. LAMELLATED HEAVY SPAR.

Lat. *Ponderosus vitriolatus lamellosus.*

Germ. *Blättricher Schwerspath.*

Its

Its colour is pale pearl, smoke and yellowish grey, yellowish white, flesh—and blood, colour.

It is a little shining, has a lamellated texture, is semitransparent. It is found in solid masses, composed of small lenticular crystals, cohering sometimes in the shape of an egg. It is found at Gersdorff, and in various mines, near Freiberg, in Saxony.

VAR. 4. GRANULAR HEAVY SPAR.

Lat. *Ponderosus vitriolatus granularis*.

Germ. *Körniger Schwerspath*.

This kind differs from the former, as the granular lime stone differs from calcareous spar; the lamellar particles are small, and confusedly mixed, which gives this mineral a granular appearance.

VAR. 5. COMMON PONDEROUS SPAR, or
CAWK.

Lat. *Spatum ponderosum*.

Ponderosus vitriolatus testaceus.

French. *Spath pesant*.

Germ. *Gemeiner Schwerspath*.

Cronst. *Marmor metallicum*.

Its

Its colour is generally white, sometimes flesh colour, brownish red, greyish black, blueish and yellowish, It is generally a little semi-transparent, often opaque; its texture is lamellar; it breaks in rhomboidal fragments.

Its specif. gr. is ≈ 4430 .

It is found solid, interspersed, and variously crystallised.

Its primitive figure seems, according to Rome de Lisle, to be an octaedron, composed of two equal pyramids, whose basis is a rectangle on two sides, the side faces meeting under an angle of 77° , and the two opposite ones, 105° , but the perfect octaedron is hardly ever found.

Varieties of regular shape.

- a. The double four sided pyramid.
- b. The oblique angular, or rhomboidal column.
- c. Rhomboidal four sided plate.
- d. The six sided column.
- e. The rectangular four sided plate.
- f. The eight sided plate.
- g. The small rhomb with obtuse angles of 105° .

All the crystals are shining in different degrees, have a lamellated texture, are more or less

less semitransparent; they are generally composed of 84 parts of Baryt, 13 of sulphuric acid, and 3 of water.

The heavy spar is the most common matrix of ores; is frequently found in Saxony, Hungary, on the Harz, and in many parts of England and Germany.

VAR. 6. BARY SPAR.

Germ. *Stangen—Spath.*

Its colour is white, greyish, and greenish white, has a lustre similar to mother of pearl; it is only found in needle-shaped crystals, which cohere and form bars; it is semitransparent, and was found near Freiberg, in a mine called Lorenzgegentrum.

VAR. 7. FIBROUS HEAVY SPAR.

Lat. *Ponderosus vitriolatus fibrosus.*

Germ. *Fasriger Schweerspath.*

a. *From Sicily found in gypsum and heavy spar.*

This kind has a light white colour, a little inclining to yellow; it is found tubular; has a dull surface; it is a little shining, sometimes only glittering, semitransparent on the edges; when

when longitudinally broken, its texture is lamellar; and when transversally broken, striated and fibrous. The druse cavities contain generally native sulphur.

b. From Frankstown in Pennsylvania.

This kind is of a sky blue colour; it is found compact in thin strata, between blueish grey slaty clay; it is glittering, has a silk lustre; its texture is undulated fibrous, and a little semitransparent.

Its specif. gr. = 3,414.

VAR. 8. LAPIS AZEROSUS.

Germ. *Aebrenstein of Blumenbach.*

This is a remarkable kind of the snow white heavy spar; it contains small oval pieces of grey compact marlstone, interspersed in such a manner, that they exhibit sometimes the appearance of corn ears. When cut, it exhibits a beautiful appearance.

It was once found near Oosterode on the Harz.

VAR.

VAR. 9. BONONIEN STONE, or BONONIEN PHOSPHORUS.

Lat. *Ponderorus vitriolatus Bononiensis.*

Born. *Baryte spathique, grise, cristallisée, en crête de coq.*

Ital. *Pietra di Bologna.*

French. *Pierre de Boulogne.*

Germ. *Bologneser Stein.*

Swed. *Tarninge Spath.*

Its colour is smoke-grey ; it is found in roundish flat, rheniform pieces ; has a lamellated texture, sometimes radiated, but always spathous ; it is a little semitransparent, and breaks in rhomboidal shaped pieces.

Its specif. gr. = 4,440.

It yields by analysis 62, sulphate of baryt 16 filix, 14,75 argill. earth, 6 gypsum, 0,25 iron, and 2 of water. It is only found on the mountain Paterno near Bologna.

It has been used for making stones, which are luminous in the dark, and are called in German, *Licht Magnet.*

DIVISION.

DIVISION III.

Baryt mixed with Petroleum.

BITUMINOUS PONDEROUS EARTH.

Terre pesante Bitumineuse.

Born. *Terre Barytique penetrée de petrole.*

The stones formed of this substance have a lamellated, or compact texture, and a shining surface; they are opaque; they contain petroleum, and flex; they are hard enough to take a polish like the alabastre; when rubbed, they emit a bituminous smell like hepar of sulphur. To this kind belongs properly the so called *liver-stone*, *Pietra Hepatica*.

Waller. *Gypsum frictione foetidum.*

Born. Catal. Raïson. *Baryte hepathique.*

This stone has a spathous appearance; emits sometimes a bituminous smell without being rubbed. It is found in Norwegue, and in the
alum

alum mines at Schoonen; its colour is white or black; it loses its colour in the fire; does not effervesce with nitric acid; it is composed, according to Bergman, of baryt, silic. earth, alum, and gypsum.

GENUS VIII.

STRONTION GENUS.

THIS Genus includes such stones as have the strontion earth, (whose distinguishing properties are mentioned in the first part of this work, page 45.) for their basis.

DIVISION I.

Strontion earth united to carbonic acid.

SPEC. I.

STRONTIONIT.

This substance has its name from the place called *Strontion* in Scotland, where it is found
in

in granit rocks, accompanied by galena and whitherit.

It is found in solid masses, has a fibrous texture; it appears as if composed of long fibres adhering to each other, and disposed in a radiated manner; its colour is generally whiteish and asparagus green, which appears deeper towards the centre of the mass; when broken, its surface is a little shining in certain directions; it is brittle; it breaks in bar-shaped pieces; is a little semitransparent, somewhat inclining to opaque; its surface can be scratched, but not well scraped with a knife.

Its specif. gr. = 3,586.

It is not acted upon by sulphuric acid, but is readily soluble in diluted nitric, and in muriatic acid, with a strong effervescence; when exposed to heat, it does not crackle, nor split asunder; it does not melt by strong heat, but it discovers, when exposed to strong heat, a bright phosphorescent light, becomes more brittle, and loses its greenish hue; it melts with borax and soda with ebullition.

By analysis, I found it yielded 68 of strontion earth, 30 carbonic acid, 1 of calcar. earth, and a little phosphate of iron and manganese, which probably gives it a colour.

CLASS

CLASS II.

This Class comprehends the

SALTS,

Which are found native in, or on the surface
of, the earth.

These Salts are divided into
ACIDS—ALKALINE, and—NEUTRAL SALTS.

And the neutral salts are divided again into
such as are composed

1. Of acids, and alkaline salts ;
2. Of acids, and earths ;
3. Of acids and metallic oxyds.

The distinguishing properties of each of the
component parts of the Salts, are mentioned
in the beginning of this work.

DIVISION I.

ACIDS.

There is but one kind known, which is
found in nature in a free state.

T

VAR.

VAR. I. BORACIC ACID, or *Acid of Borax*.

This substance is exhibited in small hexangular, scaly particles, of a silver white colour. It discovers only a slight acid taste; is indissoluble in air, melts in the fire into a vitreous mass, and renders other refractory minerals easily fusible. In water it dissolves tardily, in spirits of wine more readily; its solution in spirits of wine, burns with a green flame. It is found in the earth, in various parts of Tuscany, and near the mountain Rotundo, in the Florentine territories, where it remains, freed by evaporation from water.

It is also found in the rivers near the sea, in Siena, where it was discovered by Mr. Höpfer.

DIVISION II.

ALKALINE SALTS.

VAR. I. SODA, or MINERAL ALKALI.

Nitrum of the ancients.

Borech of the Persians.

Kien of the Chinese.

It is found of a yellowish grey colour, mostly in a state of powder, seldom compact, generally mixed with clay. It is found near
Deberedzin

Deberedzin in Hungary, where it is used for soap; it is found crytallized in Barbary; it is used in glass manufactories, for making soap, for bleaching and dying. When purified, it is employed for medicinal purposes.

In Egypt, where it is found in great quantities, it is eaten with bread at meals. It is also found in abundance, in China; and, very lately, in certain undermined fortifications at Verona, Lorgna, and on the hill of San Columbano, and also near Pavia.

DIVISION III.

NEUTRAL SALTS.

GENUS I.

SULPHATES,

Or sulphuric acid, united to alkalies, earths, or metallic oxyds.

A. COMBINATION OF SULPHURIC ACID AND ALKALIES.

SPEC. I.

SULPHURIC ACID, *united to soda.*

Sulphate of soda, commonly called Glauber's salt.

This salt is soluble in water, has a bitterish cooling taste; when exposed to a warm atmos-

T 2

phere,

phere, it loses its transparency, and water of crystallization, and becomes a light white opaque powder. When perfectly crystallized, the crystals exhibit an elongated octaedron, having the pyramids near the basis truncated; which gives it the appearance of a hexangular prism, with unequal sides; terminating by two faces in one point.

The sides exhibit two rectangular, and eight trapezoid faces, or the crystal has twenty edges, and twelve angles. Sometimes the four principal angles, or the four opposite acute edges, or both together, are wanting. This salt is found in mineral waters, in various countries, and in the sea, on the coast of Siberia.

SPEC. II.

SULPHURIC ACID *united to Ammonia.*

This is found in the crater of mount Vesuvius, and in the sea near Siena. It is a white astringent salt, resembling vitriolic substances. When it contains iron, it has a yellowish cast.

SPEC.

B. COMBINATION OF SULPHURIC ACID AND
EARTHS.

SPEC. III.

SULPHURIC ACID *united to Magnesian earth.**Sulphate of Magnesia.**Epsom salt.**Bitter salt.*

This salt is found in mineral waters, and also on gypsum near Jena in Germany; it is found in the alps, and in Switzerland, in a powdery state, sometimes in pieces, or in the state of incrustation, with a fibrous texture. It has a bitter taste, is easily soluble in water; it decomposes on exposure to a warm atmosphere; its regular figure is that of a rectangular prism; its two end faces are covered by three angular prisms, which are placed opposite each other.

The side faces of the prism, exhibit thin oblong pentagons, and the other four sided faces are rectangular; the whole crystal has eighteen edges, and twelve angles. Its principal modification is, that the four angles are truncated, on both extremities of the prism, &c. It is used in medicine as a purgative.

SPEC. IV.

SULPHURIC ACID, *united to argillaceous earth, or Alum.*

This has an acid, astringent and sweetish taste. It is found crystallized; the crystals are soluble in hot, though but little in cold, water. They tumefy when exposed to heat, lose their transparency, and become very light and spongy, on losing their water of crystallization.

Its regular shape is the perfect octaedron, which is often found modified, the middle part of the crystals becoming prismatic.

It is used for dying, &c.

It is frequently found in Switzerland, on the Alps, and in the craters of volcanoes.

VAR. I. HAIR SALT, VITRIOLUM IDRIENSE,
OR HALOTRICHUM.

It is of a silver white colour; has very fine capillary crystals, which generally adhere, and form sometimes compact pieces.

It has a silky lustre; it is friable; has a sweetish astringent taste; is very light.

It is found in the quicksilver mines at Idria, in Crain, on clay, and is often coloured by cinnabar.

VAR.

VAR. 2. ALSO THE ALUMEN PLUMOSUM, OR
FEATHER ALUM.

French. *Alun de Plume.*

It belongs to the alum kind, and is composed of thin long shining fibres of a whitish green colour. It is found, very fine, on a high mountain in the canton of Uri.

VAR. 3. MOUNTAIN BUTTER.

Vitriolum alumen butyraceum.

Russ. *Kamenoemasso.*

Its colour is yellow, it has a waxy lustre; its texture is lamellar, a little semitransparent, soft and friable; it is fatty to the touch; it has a sweetish astringent taste, and is found oozing out of the surface of the aluminous shistus.

It is found in Siberia.

C. COMBINATION OF SULPHURIC ACID AND
METALLIC OXYDS, CALLED NATIVE VI-
TRIOL.

Germ. *Natürlicher Vitriol.*

Fr. *Vitriol Natif.*

SPEC. V.

SULPHURIC ACID, united to Oxyd of Iron,
Sulphate of Iron, Martial Vitriol.

Germ. *Eisen Vitriol.*

Fr. *Sulphate de fer.*

This salt has an emerald green colour; it is found in lumps, stalactitical, and crystallized; it is a little shining, has a lamellated texture; is semitransparent, and easily soluble in water. When exposed to air, its surface loses its transparency, and falls into a white powder, or becomes ochry and yellow.

Its regular figure is the parallelepiped, whose faces have angles of 82° and 98° .

When exposed to a strong heat, it parts with the acid, on which account it is used in Germany, in the vitriolic acid manufactories, at Nordhausen, and other places.

It is used for ink, or dying black, when mixed with galls, or other astringent vegetable substances; used also for making prussian blue, with prussic acid.

It originates from the decomposition of sulphur pyrites, when the sulphur absorbs oxygen, and forms the acid.

It

It is found in Hungary, and on Ramelsberg on the Harz.

SPEC. VI.

SULPHURIC ACID, united to Oxyd of Copper, called Copper Vitriol, Blue Vitriol.

Lat. *Vitriolum Cupreum*.

Fr. *Vitriol de Cuivre, or Sulphate de Cuivre*.

Germ. *Kupfer Vitriol*.

Its colour is sky, or deep sapphire, blue; it is found stalactitically crystallized; it is soluble in four times its weight of water; the alkaline salt precipitates the oxyd of copper from it, in the state of a fine blueish green precipitate.

Its regular figure is the four sided prism, with rhomboidal faces.

The crystals have a fibrous texture, they are semitransparent; have a nauseous astringent taste. A polished iron plate immersed in a solution of it, precipitates the copper in its metallic state, upon the surface of the iron plate. It is found in Austria, and near Salanta in Transylvania; in the subterraneous waters of Sweden, Ireland, and Hungary.

SPEC.

SPEC. VII.

SULPHURIC ACID *united to Oxyd of Zink.**Native Vitriol of Zink.*Lat. *Vitriolum nativum Zinci.*Fr. *Vitriol natif de Zink, or Sulphate de Zink.*

Its colour is white, reddish, or greenish white; it is found in the state of powder, partly in lumps, tubular, and also crySTALLIZED. Its regular figure is the rhomboidal octaedron. It contains generally a little oxyd of iron and copper.

It is found near Sahlberg in Sweden, and near Kremnitz, at Goslar.

SPEC. VIII.

SULPHURIC ACID, *united to Oxyd of Cobalt.**Sulphate of Cobalt.*Germ. *Kobalt—Vitriol.*

It is of a reddish colour; it is difficultly soluble in water; it melts with borax into a
blue

blue glass; the regular figure of this salt is the elongated octaedron, exhibiting a prism.

It is very seldom found in the mines near Neusohl, first discovered by Volta.

SPEC. IX.

SULPHURIC ACID *united to Nickel.*

Sulphate of Nickel.

This salt is generally found with martial vitriol, and originates from the sulphurated ores of nickel; it has a deep green colour, and is difficultly soluble in water.

GENUS II.

NITRATES.

SPEC. I.

NITRIC ACID *united to Potash.*

Niter. Nitrum. Saltpeter.

Nitrate of Potash.

This salt is white or colourless; it is easily soluble in water; gives a cooling sensation to the

the tongue; when thrown upon red hot charcoal, it detonates; it is found in a state of efflorescence on the surface of the earth, partly in the state of incrustation, partly crystallized; its regular figure derived from the elongated octaedron, is prismatic. It is used for gunpowder, and yields the nitric acid.

It is found in Virginia, Spain, Sicily, Calabria, and the Ukraine.

SPEC. II.

NITRIC ACID *united to calcareous earth.*

Nitrate of Lime.

This earthy salt deliquesces when exposed to the atmosphere: it is found in certain mineral waters in Sweden.

GENUS III.

MURIATES.

Or Muriatic Acid united to different Substances.

A. COMBINATION OF MURIATIC ACID AND ALKALIES.

SPEC.

SPEC. I.

ROCK SALT.

*Muriate of Soda.*Lat. *Sal gemmae.*Germ. *Stein Salz.*Fr. *Sel fossile.*

This salt is found colourless, and of various colours, viz. greyish, yellowish, reddish, blue, or brownish.

It is found in solid masses, and crystallized in cubes. It breaks into cubical pieces, and, when exposed to a sudden heat, crackles. It is found in Poland, Gallicia, Hungary, and in various other places; a certain kind of rock-salt has a fibrous texture, of a lavender blue, or flesh colour.

The common salt, which is obtained by evaporating the water of salt springs, is of the same nature, only purer, and therefore more fit for culinary purposes. The common salt is used in potteries for glazing the surface of certain earthen ware. It yields besides, the muriatic acid.

SPEC.

SPEC. II.

MURIATE of POTASH, or *muriatic acid*,
united to potash.

This salt is crystallizable, and soluble in spirits of wine; it is found in mineral waters, particularly in Italy.

SPEC. III.

MURIATE of AMMONIA. *Sal Ammoniacum*, or *muriatic acid united to Ammonia* or *volatile alkali.*

Lat. *Sal ammoniacum nativum.*

This salt is found of a yellowish grey apple green, or brownish black colour; it is found in loose particles, and also in compact masses; it has a sharp taste, and emits a strong volatile smell, when rubbed with quick lime or potash; it is used for sodering, and, when purified, in medicine.

It is found in Persia, and in the craters of Italian volcanoes.

.B. Com-

B. COMBINATION OF MURIATIC ACID AND
EARTHS

SPEC. IV.

MURIATE of LIME, *or muriatic acid united
to calcareous earth.*

This salt is found in mineral waters, sometimes mixed with common salts; it deliquesces when exposed to the atmosphere; and when mixed with common salt, makes it absorb moisture.

C. COMBINATION OF MURIATIC ACID AND
METALLIC OXYDS.

SPEC. V.

MURIATE OF COPPER, *or muriatic acid
united to oxyd of copper.*

This salt is found in scaly deep green shining particles, resembling the green kind of mica. It is found in a mine in Saxony; a very fine specimen of it is preserved in a collection at Pavia.

GENUS

GENUS IV.

BORATES.

SPEC. I.

BORACIC ACID *united to Soda. Borax Tinkal.*

Its colour is greyish white, or greenish grey. It is found in plates, and flat six sided columns, or, according to Rome de Lisle, four sided prisms; it is semitransparent, has a mild taste, is soluble in water; its acid is separated from soda, by sulphuric acid.

It melts easily in the fire, and renders other minerals easily fusible, wherefore it is used for experiments with the blow-pipe, and for soldering.

It is found in the Alpine Sea, and in the snow topped mountains of Tibet.

CLASS

CLASS III.

COMBUSTIBLE SUBSTANCES.

BY this denomination are understood, such mineral substances, as burn, or more or less easily consume, when exposed to heat. Some of them as sulphur, and charcoal, are entirely consumed by fire, and produce carbonic or sulphuric acid; others leave a coaly substance behind; certain kinds are liquid, and of an oily nature, others hard, and of a bituminous nature, emitting, when ignited, a strong smell. The first kind is not so easily inflammable as the latter. The solid ones are positive, and idioelectric. They are not soluble in water, nor in diluted acids.

U

GENUS

GENUS I.

DIAMOND.

Lat. *Adamas*.

The name *adamas* is probably derived from the Greek ; it signifies a substance which is indestructible, on account of its extraordinary degree of hardness, &c.

It is generally ranked with the gems of the siliceous kind, which it resembles ; but as it is found to consume in fire with a flame like other combustible substances, it may, with more propriety, be ranked with the inflammable substances.

This substance, which possesses by far the greatest degree of hardness, transparency, and lustre, of any of the inflammable bodies, differs from the siliceous gems by its combustion, in a heat equal to 900° Fhr. and by its not being acted upon by any liquid acid.

It

It bears some resemblance to the finest crystallized quartz crystals; it is found colourless, and of different colours, viz. red, greenish, yellowish, brownish, or black. The colourless kinds are reckoned the most valuable, and the black kind, the scarcest.

Its lustre resembles somewhat the metallic lustre; it resists the file, and can only be polished by its own powder.

Its specif. gr. = 3,100, 1,000; but that of the coloured ones, is a little more: it is idioelectric when rubbed.

It is found in roundish granular, and in angular pieces, sometimes crystallized; those from the East, exhibit generally octoedrical crystals, or a double four sided pyramid; and those from Brazil, exhibit dodecadral crystals, with rhomboidal faces, which make a six sided prism, terminated by two three sided pyramids; in the East-Indies, they are found at Golconda, at Bengal, in the river Gouel, and in the river Sucadan, on the island Borneo, and at Visapour, on the Peninsula Malacca,

The matrix is generally quartz-sand and ironstone, or granit; they are found at the foot of the granit mountains of Indostan.

Those from Brazil have less lustre.

The following very remarkable specimens, with regard to size and value, may be noticed :

1. That which is in the possession of the Great Mogul, its weight is 279 carats, and is valued at six millions of florins (about 540,000*l.* sterling.)

2. That belonging to the Grand Duke of Tuscany, weighs 139 carats, and is valued at one million of florins (about 90,000*l.* sterling.)

3. That in the possession of the king of Portugal, weighs 215 carats.

4. The diamond which the Stadtholder Pitt sold to the Prince Regent, the Duke of Orleans, for the late king of France, for 1,500,000 livres. Its weight is 547 grains; and there is one in the crown of France of 106 carats.

5. Mr. Gregor Saffraz, of the family of Gogia Minazian, was in possession of a diamond, from the East Indies, weighing 779 grains—
And

6. The rough diamond from Brazil, in the possession of the King of Portugal, weighs 1680 carats.

GENUS

GENUS II.

BITUMINOUS SUBSTANCES, or BITUMINA.

In German, *Erdharzige Substanzen.*

DIVISION I.

LIQUID BITUMENS.

SPEC. I.

NAPHTHA. BIUTMEN. PETROLEUM.

This is a liquid mineral, oily, colourless, transparent substance, having a sharp taste, and disagreeable smell. It is lighter than water, and spirits of wine.

Its specif. g. is generally ≈ 847 .

At a short distance from flame, it catches fire; it is not soluble in spirits of wine, nor miscible in water; when exposed to the atmosphere, it becomes first yellow, then of a deeper colour, and then evaporates.

It is found frequently in Persia and Media, where it oozes like water out of sand-stones; and near Baku, on the western coasts of the Caspian Sea. The finest sort is brought from a peninsula in that sea.

SPEC. II.

IMPURE and COLOURED PETROLEUM,
*rock oil.**Petroleum impurum.*Waller. *Bitumen fluidum.*

Its colour is generally fire red, or brownish black; it is of a thicker consistence, than the Naphtha, and is not so transparent; it is fatty to the touch—lighter than water, but heavier than spirits of wine; it has a bituminous smell, is less inflammable than Naphtha, and mixed with heterogeneous particles.

This kind is also collected from the surface of certain springs, and near Baku, on the western coast of the Caspian Sea, also in Persia, and on the Peninsula Boral; and Abscheron in Siberia, near Semenowa; in Westphalia; in Bavaria, near the Tegern Sea; in Switzerland, near Bern, and Chateauboy; in Scotland, and
in

in various other places, is found oozing out of coal flötz, and floating upon certain hot wells.

The yellow kind is generally found near Modena in Italy; the red is found in Gabien, and in Alfatia; and the brown and blackish kind in England, Italy, France, Germany, and Sweden.

SPEC. III.

TAR.

Germ. *Bergtheer.*

Waller. *Bitumen Malta.*

Cronst. *Petroleum induratum.*

French. *Petrole tenace.*

This kind is of the consistence of treacle; is of a blackish brown colour, opaque, and has a very strong smell; it seems to originate from the foregoing species, which, by long exposure to air, has lost its volatile particles, and thus obtained a thicker consistency.

It is found at Malta, and at Baikal near Bargusen, where it is deposited by the sea; it is also found on the surface of springs in the duchy of Modena, and in various parts of France, Germany, and Switzerland; in Dauphiné, and Pietramala.

It is used for varnishing ships ; and of late, as a remedy for certain diseases.

DIVISION II.

SOLID BITUMENS, *or* FOSSIL RESINS.

These substances, in consistence and appearance, are like the resins obtained from vegetable balsams ; they are produced by the inspissation of *Petroleum* ; they are generally shining, not soluble in spirits of wine, nor in water ; they are brittle, and melt by heat, burn, and leave an acid substance behind ; when rubbed and held near a glass, they emit electric sparks ; and some of them have a vitreous lustre.

SPEC. IV.

BITUMEN.

Germ. *Bergpech, Judenpech.*

Born. Cat. Rais. *Petrole solide.*

Waller. *Bitumen asphaltum.*

It derives its name *Asphalte*, from a lake called *Asphaltide* in Judea. It exhibits a hard black shining resinous-like substance. It is
very

very brittle; when exposed to heat, it melts, burns like pitch, and then gives the smell of burnt amber. It is principally found on the Dead Sea.

Its specif. gr. is $\approx 1,104$.

It is found on the lakes of Judea, China, Denmark, and Sweden; it was used by the ancient Egyptians for making mummies, and it is now used, when dissolved in oil, for varnishing coach leather, and for certain purposes in medicine.

SPEC. V.

GAGAT.

Bitumen Gagates.

Born. Cat. Rais. *Petrole compacte, &c.*

This substance seems to be a variety of the asphalt; is less shining, much harder, but not so brittle; it takes a polish like marble, and is, in some places, made into buttons and other vessels.

It melts in the fire like asphalt, and when burnt, emits a thick greyish black smoke, and a bituminous smell. It is found in England, France, Italy, and in various parts of Germany.

It

It is lighter than sea water ; when broken, it has a conchoidal surface : it is found in the earth in pieces, in Sumatra ; the river Wolga, above Syfran ; on Irtysch near Jamischewa, in Daurien ; on the river Tschikoi, where the Uruluck falls into it.

SPEC. VI.

ELASTIC BITUMEN.

Bitumen Asphaltum Elasticum.

Germ. *Elastisches Erdharz.*

This substance is of a brown colour, has no lustre, and is very elastic, is soft enough to be compressed with the fingers, and burns with a light flame ; it is found near Castle-ton, in Derbyshire, in calcareous spar with Galena, where two kinds are found, one resembling the cahutschuk, or *resina elastica*, which burns with a bright flame ; it becomes softer by heat, and is generally accompanied with lime-stone, and calcareous spar.

The other kind is not so compact, is of a lighter brown colour, and rather spongy.

SPEC.

SPEC. VII.

MINERAL MUMMY.

Its colour is blackish brown, more tough than asphalt; has rather a pleasant balsamic smell; is only found in cliffs of rocks at Chorassau on the river Caucasus, which is accessible but once a year, and therefore this substance is very scarce.

Mr. Herman has found it on the water of a spring near Strasbourg.

It is soluble in spirits of wine. A similar substance has been found in Lancashire.

GENUS

GENUS III.

COALS, OR SUBSTANCES CHIEFLY EMPLOYED FOR FUEL.

SPEC. VIII.

COAL.

*Lithantrax.*Fr. *Charbon de Terre, houille.*Germ. *Steinkohle.*Waller. *Bitumen Lithantrax.*

This coal is black, compact, more or less shining, and mostly brittle. It burns with a yellowish and blackish smoke; its combustibility depends on the quantity of oil, or bituminous matter, which it contains. A particular kind seems to be formed from a flaty clay, found under stagnant waters, and impregnated with the vapours of petroleum, which were set lose by subterraneous heat. Other kinds exhibit many marks, which shew that they have chiefly originated from vegetable substances, as they are often found containing charcoal, &c.

Coal forms large stratified or flötz mountains near Newcastle; is mostly covered with flaty clay. It is also found in various other clayey flötz mountains, which had formerly been covered, for a long time, with stagnant water or lakes.

Coals

Coals are most frequently found in mountains, containing lava and columnar basaltes, which shew that volcanoes which are now extinct, existed there formerly.

Indeed it seems to be probable, from certain marks, that all places which yield coals, were formerly covered with stagnant lakes; at the bottom of which, great quantities of plants and sea animals of all kinds, were collected, and that the oil separated by the water, from those plants and animals, had contributed, not only to the formation of the coal, but also to the formation of other sulphuric combinations, or products, which are found there, and which, by subterraneous fire, had been altered.

Coals yield also volatile alkali, water, and oil; and when burnt, yield ashes, composed of feruginous clay, or, sometimes, flaggy porous masses of different kinds.

The coals found in the upper part of the coal flötz, burn quicker, but give not so much heat.

The following varieties of coals may be noticed.

VAR. I. SLATY COAL.

This kind has a slaty texture, a fat lustre, is jet black, stains a little, and resembles, in
other

other respects, pitch coal. When transversely broken, it exhibits a conchoid surface.

VAR. 2. PITCH COAL.

Lat. *Bitumen Lithantrax piceus.*

Germ. *Pech-Kohle.*

This kind is also jet black, shining, and sometimes a little variegated. It is found compact, in large beds; when broken, it appears conchoidal.

VAR. 3. SHINE COAL.

Germ. *Glanz Kohle.*

It is generally of an iron-black colour; when broken, it has a conchoidal shining surface, something of a metallic lustre, and breaks in cubical fragments; the fragments are brittle. It is found compact, forming flötz mountains; sometimes found interspersed, and of a cubical shape.

VAR. 4. LAMELLAR COAL.

Germ. *Blätter Kohle.*

It is of a deep black colour, strong, shining, has a lamellated texture, and breaks in rhomboidal

boidal pieces. It has often somewhat the appearance of the rainbow, and is very brittle. It is found near Burg, and Wurgewitz, near Dresden, near Ilmenau, &c.

SPEC. IX.

BITUMINOUS WOOD. *Bovey Coal.*

Waller. *Lithantrax ligneus.*

Fr. *Bois fossile bitumineux.*

Germ. *Bituminöses Holz, Braune Kohle.*

Its colour is liver brown, or blackish brown; it resembles wood; its surface is rough, and longitudinally striated; its texture shivery; it is formed from dead wood, penetrated by bitumen, which has prevented its entire decomposition; its colour and hardness differ, according to the quantity of bitumen, which it has imbibed. It is found in Iceland, in beds such as other coals are found in.

VAR. I. BITUMINOUS WOOD EARTH.

Its colour is brown, and sometimes blackish; is friable, and seems to be composed of compact powdery particles; it stains; it is found in Siberia, and near Merseburg.

SPEC.

SPEC. X.

TURF.

Fr. *Tourbe*.Waller. *Humus fibrosa combustibilis*.

This is an irregular mixture of vegetable and animal substances, which have been collected at the bottom of stagnant waters, or moor ground, and which have in time been changed into a bituminous substance. It resembles a blackish, coarse earth, cut into longish rectangular pieces, of a foot long; are used for fuel.

Holland, Zeeland, and Oostfriesland, are the best places for digging and preparing the turf. There is also another kind of turf, apparently composed of fibrous roots, mosses, and grasses. It is found in moor ground, more or less impregnated with petroleum, or bitumen; it is generally of a brownish black colour, frequently found in Germany, and in Grönland.

GENUS

GENUS IV.

COMBUSTIBLE SUBSTANCES OF A DIFFER-
ENT NATURE FROM THE FOREGOING.

SPEC. XI.

AMBRA. *Ambrosiaca.* Lin.Fr. *Ambre-gris.*

This substance appears as a scaly, compact, greyish, pale yellowish, or blackish, opaque, mass, without lustre. It breaks easily, but cannot be readily reduced to powder; its texture is granular; it melts like wax, and sticks to the teeth like mastich; has a fragrant smell, but no particular taste. Its specif. gr. = 926; it is somewhat soluble in spirits of wine, by the assistance of heat, and gives the spirits a yellowish brown colour.

The grey kind is collected by the Molucks, and the whiteish and blackish kinds are found near Nicobar, on the sea coast, and on the surface of the sea.

Some naturalists suppose it to originate from animals; others, from vegetables; but according to the best accounts, it belongs to the mineral kingdom.

It is generally found in small lumps in the East Indies. A piece of it of more than an ounce weight, is very dear. A mass of it

X

weighing

weighing 225 pounds, was sold for 52,000 livres.

It was formerly used in medicine, and is now used as a perfume.

SPEC. XII.

AMBER, *Succinum. Electrum.*

Fr. *Amber jaune.*

This substance is composed of bitumen, and a peculiar acid. Its colour is generally honey yellow, which is sometimes pale and deep; it is found transparent and semitransparent; is sometimes milky and opaque. Its specif. gr. = 1083.

It is found solid, but never crystallized; it possesses various degrees of resplendence, has a vitreous appearance, and when broken, exhibits a conchoidal surface. It is brittle, and can easily be reduced to powder; it is highly electric; melts with more difficulty than the other bitumens. While burning, it emits very pungent white vapours.

It is often found enclosing insects of the small kind; it is found at a considerable depth from the surface of the earth, in Prussia, and
on

on the shores of the Baltic sea ; and, frequently, in East Prussia, in layers of bituminous wood. It is also found in great quantity, in the two lakes, called the Curish and Fresh Haff. It may also be found on the eastern ocean, and on the shores of it ; and, very pure and good, at Madagascar.

It is susceptible of a good polish, and is therefore made into various vessels, necklaces, trinkets, and other ornaments.

It is also used in medicine ; is supposed to attract the catarrh.

There is another species of it called Copal.

Waller. *Succinum Copal.*

Electrum Copal.

It has the same properties as the amber, but being softer, may be more easily cut into vessels. It is found near the coast of Guinea, at considerable depths below the surface of the earth.

N. B. It must not be confounded with the copal produced by a certain tree.

SPEC. XIII.

HONEY STONE.

Bitumen melleum.

Germ. *Honig stein.*

X 2

This

This substance was first discovered by Mr. Werner, in bituminous wood, in the principality of Mansfeld. It resembles in colour, texture, and transparency, the honey-yellow amber, but it differs from it in this, that it crystallizes in small double four sided pyramids, and when held in the flame of a candle, does not burn, nor does it emit a smell like amber; it becomes only white, opaque, and very brittle. It is also found in Switzerland, in Asphalt, and in layers of bituminous wood.

SPEC. XIV.

SULPHUR.

This substance has of late been considered as a simple substance. It is a compact, brittle, substance, generally of a yellow colour; it is found in compact, opaque masses, and also crystallized, when it is semitransparent; it becomes liquid at 244°. Fahr. when it appears transparent, and of a red brown colour; it kindles and burns with a more intense heat, when in contact with air that contains oxigene; it combines with the oxigene, and forms the sulphuric acid; if heat be applied, it decomposes water, by uniting with its oxigene; the
hydrogene

hydrogene is therefore let loose, and appears in the state of inflammable gas.

It has a strong affinity to certain metals, with which it is frequently found combined in nature, as will appear by the different pyrites; it is not soluble in water, nor in diluted acids; it is electric; it burns with a blue flame, leaving, if pure, scarce any *residuum*; it is soluble in fat oils, and in costic or pure alkalies.

It is found in the craters of volcanoes, and in several mineral waters, partly dissolved in hydrogene gas, forming hepatic air, which is found in certain mineral waters.

It is also found in mount Vesuvius, and *Æt-na*, and in rocks of selenite; it is found in small pieces in gypsum, in layers of clay, in lime, and in semitransparent eight sided capillary bodies, united together, or in rhomboidal crystals.

The best sulphur mines are found in Sicily and Naples.

Its use in common life is sufficiently known.

Varieties of Sulphurs.

VAR. I. NATIVE SULPHUR. *Brimstone.*

Lat. *Sulphur nativum commune.*

Germ. *Gediegener Schwefel.*

Waller. *Sulphur vivum flavum.*

Ital. *Solfo nativo.*

Fr. *Soufre natif.*

This is of a pale yellow colour, more or less semitransparent, more or less pure.

Its specif. gr. = 2033.

It is found compact, frequently with alabaster and gypseous spar, partly crystallized in double eight sided truncated pyramids. Sometimes it exhibits only three sided pyramids, or four sided columns; is sometimes of a tabular, cubical, or stalactitical shape.

It is found in the craters of volcanoes.

In Iceland, and other countries, there are found whole layers of sulphur, of a foot and more in diameter, partly in a powdery, partly in a crystallized state, near the surface of the earth.

It is found in all the parts of the world, Sulphur is also found united to arsenic, when it exhibits a red colour.

VAR. 2. NATIVE HEPAR OF SULPHUR.

This is a mixture of lime or potash and sulphur; it has the smell of rotten eggs; is mostly of a grey or yellowish colour; has an earthy appearance.

It

It is generally found near the sulphurous mineral waters, and also in volcanoes.

Sulphur united with clay, is sometimes found in the mountains of Nertschinsk, and in the mines of Schilka.

SPEC. XV.

COAL BLENDE.

Fr. *Charbon de Terre incombustible.*

Germ. *Kohlen blende.*

This substance resembles coal; is generally of a deep iron black colour; has a strong metallic lustre, a flaty texture; it breaks partly in cubical pieces; is opaque, brittle, stains a little, and is almost incombustible in fire. It was lately found in various parts of Europe, frequently near Gera, also in Walliser, and Piedmont.

SPEC. XVI.

BLACKLEAD. PLUMBAGO.

Werner. *Graphit.*

Fr. *Crayon noir.*

Lat. *Graphites.*

X 4

This

This substance is generally of an iron grey colour, partly blackish, has a slight metallic lustre; is opaque, greasy to the touch, stains and suffers impressions from the nail. It has a granular texture. When exposed to an open fire, it burns with a reddish flame, and emits beautiful sparks, and a smell of sulphur; it is then consumed, all but a little siliceous earth, and iron.

The finest kind which is used for the English pencils, is found at Kefwick, in Cumberland.

It is compact, has a fine grain, and is rather a little flexible. Its specif. gr. is = 2089. It is not acted upon by acids.

Other kinds have a scaly texture; the common kinds are used to blacken stoves, and to make Ipswich crucibles for melting metals; it is also found in large layers in the German alps.

MOUN-

MOUNTAINS IN GENERAL,

AND THEIR

PRINCIPAL COMPONENT PARTS.

WE shall premise the following observations respecting mountains :

1. Their proximate component parts can generally be distinguished with a naked eye, without chemical tests.
2. Their component parts are not chemically or intimately combined.
3. Their compact state arises from the attraction and cohesion of component parts, brought in contact, when they were all or a part of them in a fluid state, or when they were cemented by heterogeneous substances, and that heat was occasionally applied ; or it arises more or less from alteration by fire.

As the substances of which mountains are composed, are of a different nature, and consequently

quently exhibit a different appearance and structure, it has been thought proper to treat of the situation, principal and accidental component parts of mountains, under the following heads; and hence the following division into

- a.* Primitive.
- b.* Secondary, or Flötz mountains.
- c.* Alluvial mountains, and
- d.* Volcanic mountains.

DIVISION I.

PRIMITIVE, PRIMORDIAL, OR ORIGINAL ROCKS OR MOUNTAINS.

These denote such as are apparently of greater antiquity, than those which generally rest upon them.

They seem to be formed by precipitation or deposition.

They are generally very high mountains, and shew many marks of derangement, subsequent to their formation.

Their component parts are of different sizes, irregularly mixed; they break into differently shaped pieces, though they are generally of the same composition. Some have a lamellar appearance, and are called primitive rocks of a secondary formation. They contain no petrefactions,

tions, and are therefore supposed to have existed previous to the formation of animals and vegetables.

DIVISION II.

SECONDARY ROCKS, FLOETZ MOUNTAINS, OR REGULARLY STRATIFIED MOUNTAINS.

These seem to be of a later formation, formed also by precipitation; they consist of stratified layers, containing often petrefactions of animals and vegetables, and also metals.

These mountains shoot up irregularly; they are of various compositions; their general component parts are mentioned under proper heads.

DIVISION III.

ALLUVIAL MOUNTAINS.

These are seemingly formed by deposition, and at a later period of time than those just mentioned.

They are found near coasts, and on the beds of rivers; they are rather flat, and have the cavities, left by the secondary strata, or flötz mountains, filled up; they seldom contain petrified sea products; they contain however decomposed

composed river, and land snails, bones of land animals, and various kinds of plants, and are sometimes impregnated with bitumen.

DIVISION IV.

VOLCANIC MOUNTAINS.

These have their origin from subterraneous fire.

They appear insulated, and are mostly very high, steep, barren, or naked, and exhibit funnel shaped cavities or craters on their tops or summits, out of which different substances are thrown, which, according to their nature, have been variously altered by subterraneous fire.

DIVISION I.

Substances belonging to the component parts of the

PRIMITIVE MOUNTAINS, OR ROCKS.

1.

GRANIT.

Cronst. *Saxum compositum Feldspata, Mica, & Quartzo, &c.*

By this denomination is understood a stone, that is chiefly composed of *quartz, feldspar, and mica.*

mica. The component parts are generally irregularly mixed, and of various sizes.

The *quartz* and *mica* are found of different degrees of hardness and colour; the *feldspar* exhibits sometimes a regular shape. The *granit rocks*, which are composed of these stones, are more generally found than other rocks; they are found in the highest and deepest parts of the earth. The *granit* strikes fire with steel, and is not readily acted upon by any acid, except the fluoric; it takes a polish, and may, on account of its hardness, serve for various purposes in common life.

The component parts of the *granit* are seldom found lamellated*. The primitive *granit* contains no petrifications of animals, vegetables, or metals; but that *granit* which is of a secondary formation, contains occasionally *shörl*, *garnits*, *topaz*, *rockcrystal*, *amethyst*, *opal*, and *adamantine spar*.

2.

SIENIT.

This stone forms also rocks; it is composed of *feldspar* and *hornblende*; it contains now and then *quartz* and *mica*.

The *hornblende* characterizes this stone.

3.

* Mr. Ch. Hatchett, a gentleman well versed in Mineralogy, has lately described a *granit*, which he discovered while on his travels abroad, in which the component parts are disposed in a distinct stratified manner.

3.

GNEISS.

Born. Cat, Rais. *Granite feuilleté.*

This substance has the same component parts as the granit; but the *quartz*, *feldspar*, and *mica*, are not in a granulated state; it exhibits a flaty or lamellated texture; it is less hard than the granit, is divided by moisture into lamellated pieces; in fire, it becomes harder, and of a red colour; it contains the mica in a greater proportion than the granit. It forms large chains of rocks, and contains metallic veins, occasionally also *garnits*, *shörl*, and *turmalin*.

The mountains formed of it, generally rest upon granit mountains.

4.

MICACEOUS SLATE, OR SHISTUS.

It is composed of *mica* and *quartz*; it contains occasionally *clay*, *steatite*, *green garnits*, *shörl*, and *radiated stone*, which is called in German *Strahlstein*. The *micaceous shistus* exhibits a flaty texture; has sometimes an undulatory appearance;

appearance; it generally rests upon *porphyre* and *granit*; is chiefly covered with *argillaceous slate*, *sand*, and *lime-stone*.

Another kind of the same composition, but not exhibiting a slaty appearance, is called in German *Gestell-stein*, from being used for the purpose of coating or making the inside of large melting furnaces. It is found in the Alps, of various colours, according to the state of its component parts. In the Spanish Pyrennees, it is of a smoke-grey colour. In Norwegue, whiteish; in Tyrol, yellowish; and on Lago Maggiore, ash grey. The latter kind is called *Beola*, and is used for various purposes.

5.

HORNBLLENDE SHISTUS.

This stone is composed of *hornblende* and *quartz*. It is found frequently in *rocks of gneiss* and *micaceous shistus*, near Miltitz, in the environs of *Misnia*.

There are large beds of this stone found resting upon *lime-stone*.

6.

6.

ARGILLACEOUS SHISTUS.

This stone is chiefly composed of *common clay*, and differs from the other kind of argillaceous shistus, which is of a later formation. It forms mountains belonging to the primitive ones, such as the *altai mountains* or *rocks*; it also forms mountains in Hungary and Saxony, which are generally placed in alternate order with mountains of *granit*, *gneifs*, *micaceous shistus*, and *lime-stone*. It often rests upon flat mountains of sand stone.

7.

PORPHYRE.

This consists of a mass composed of *indurated clay*, *horn-stone*, *jasper*, *quartz*, *obsidien* or *pitch-stone*, through which *feldspar*, *quartz*, and *horn-blende*, and occasionally *mica*, are interspersed.

It is found of various colours; is a little acted upon by acids.

Mr. Karsten distinguishes the following varieties :

a. Porphyre is principally composed of *clay*, and contains *feldspar* with a little portion of *mica* ;

mica; sometimes the *feldspar* alone, or the *feldspar* mixed with *quartz* and *garnits*. It contains occasionally *calcedony*, *crystallized quartz*, and *amethyst*; but these substances are seldom found in the interior parts, most generally on the outside.

b. Porphyre, whose principal basis is *jasper* mixed with *feldspar*, is also occasionally mixed with *quartz* and *hornblende*.

c. Porphyre, whose principal basis is *hornstone*, mixed with *feldspar* alone, or with *quartz*, or *hornblende* and *quartz* together. It contains accidentally *calcedony*, *garnits*, and *zeolithe*.

d. Porphyre, chiefly composed of *quartz*, mixed with grains of *feldspar*.

e. Porphyre, chiefly composed of *pitch-stone*, mixed with *feldspar*, and *leuzit*.

The general and essential component part of the *porphyres* is the *feldspar*, which it generally contains in a crystallized state.

The *feldspar* is sometimes of a reddish colour, sometimes white.

Quartz is always more or less transparent; and *mica* seems to be peculiar to the *porphyres*, as the *hornblende* is to the *porphyre* of *hornstein*.

In Joachimsthal in Bohemia, *porphyre* is found betwixt *micaceous schistus*, and near the

Halbbrücke in the environs of Freiberg, inclosed in *gneiss*.

The *saxum metalliferum* of Born, is softer than *porphyre*, and is cemented by *clay*. The metalliferous mountains of Transylvania and Hungary, are chiefly composed of it. It contains distinct parts of *quartz*, *lythomarge*, *skörl*, and *feldspar*.

8.

PORPHYRY SHISTUS.

This is chiefly composed of *clay* mixed either with the grains of *feldspar* alone, or accompanied with *quartz* and *hornblende*, very seldom with *zeolithe*.

It has a coarse texture, either parallel, or curved, and a flaty appearance.

The mountains composed of porphyry shistus, are often found on flat land scattered, and detached like the tops of mountains. Sometimes also they form large mountains; they are generally found near the basalt mountains, and sometimes near the granit and *gneiss* mountains.

9.

9.

SCHNEIDE STEIN. *By the Germans.*

This stone is chiefly composed of *steatite*, *mica*, and *talc*, occasionally mixed with *feldspar*, *garnits*, and *turmalin*. It has generally *micaceous schistus*, *gestellstein*, *granit*, or *horn-stone* for its basis; the mountains it forms are generally found naked, sometimes they are covered with slate or lime-stone.

10.

QUARTZ.

This stone seldom forms mountains by itself; when it does, it is distinguished from the *quartz* of the *ganges* by a coarser texture, and by a greasy lustre. It is also found, occasionally, approaching to the nature of *granit*, as it is found, occasionally, to contain separate pieces of *feldspar* and *mica*.

11.

PRIMITIVE LIME-STONE.

This is a lamellated lime-stone, which exhibits sometimes a fine grained texture, resembling

bling compact lime stone. It is at times mixed with *argillaceous shistus*, *hornblende*, *asbest*, *steatite*, *serpentine*, *quartz*, *mica*, *calcar. spar*, and *garnits*.

This kind of rock is frequently found near mountains of *argillaceous shistus*, and in separate layers, of different sizes, in *gneiss* and *micaceous shistus*. In Styria, and also in Carinthia, and Carniola, and in Italy, it forms large extensive mountains, resembling primitive mountains. This kind of lime stone rock must not be confounded with the lime stone of a different origin, which is found near Blanckenburg, Steinach, in the forest of Thuringuen, which contains *trochits*; near Clausthal, and in a cavity called Baumanshöhle, which contains calcined bones.

12.

SERPENTINE.

This stone forms also mountains, or part of mountains, which are composed of *filix*, *clay*, *lime*, and *feruginous earth*.

This stone contains occasionally *steatite*, *asbest*, *amianth*, *talc*, *lythomarge*, *garnits*, *mica*, *calcar. spar*, *quartz*, *hornblende*, and *sulphur pyrites*. It forms partly separate mountains, leaning

leaning on mountains of granit, gneifs, and sand stone. Sometimes it forms mountains of considerable heights, but never very extensive.

13.

TOPAZ ROCK.

This is composed of *topaz*, *quartz*, *shörl*, and *lythomarge*. There is only at present, one spot known where this stone forms considerable parts of mountains, which is at *Schneckenstein*, near *Auerbach*, on the metallic mountains, called in Germ. *Erzgebürge*, in Saxony.

14.

TRAPP.

This is a mixed stone, composed of *hornblende*, *quartz*, and *feldspar*, in which the *hornblende* predominates, and appears so intimately combined with the *quartz*, that they can hardly be distinguished. The *feldspar*, which it contains, is found in long grains, as in the *porphyry schistus*. The *feldspar*, however, is very rarely found in these stones, and is by that means distinguished from the *sienit* and *porphyry*.

It contains accidentally *calcareous spar*, *micaceous iron ore*, *magnetic iron stone*, and *sulphur pyrites*.

Trapp seldom forms long contiguous mountains; it generally forms the tops of large mountains; sometimes it forms scattered parts of rocks; when found covered, which seldom happens, its covering is sand stone of a *clay cement*, *granit*, or *primitive lime stone*.

DIVISION II.

Substances of which are chiefly composed, the
FLÖTZ, OR REGULAR STRATIFIED MOUNTAINS.

1.

WACKE.

This stone comes under the head of the argillaceous genus, and belongs to the simple composed mountains; it is found partly upon gangues, partly in the state of layers, under, and sometimes between, basalt. It is found often approaching to the nature of basalt.

2.

2.

BASALT.

This is also a simple kind of mountain, which is composed of *siliceous, argillaceous, magnesian, calcareous, and feruginous*, earth. It contains occasionally *olivine, hornblende, calcareous spar, calcedony, zeolithe, mica, bole, spathous iron stone, marl, sulphur pyrites, petrifications,* and impressions of leaves.

The basalt mountains are frequently found in Saxony, Thuringia, Hesse, &c. They generally form very steady cupolas, which rest upon wacke, clay and sand, or upon coal-flötz. They contain lime-stone, horn-stone, and sand-stone.

3.

ALMOND STONE.

This is a mixed kind of stone, which is chiefly composed of wacke, but it approaches sometimes to the nature of basalt. This stone contains various other substances, in the state of stones more or less rounded and of different sizes, resembling almonds.

Mr. Karsten mentions the following varieties.

A. BASALTIC ALMOND STONE.

Though Mr. Karsten considers this variety as a harder kind of almond stone, than generally met with, yet, by several mineralogists, it has been described as basalt, for it is sometimes difficult to decide, whether it is more properly called basalt, or almond stone, as both kinds resemble each other so much. As to colour, it is found reddish brown, deep grey, and greyish black. Sometimes it contains globules of calcedony, sometimes *calcareous spar*, *hornblende*, and *zeolithe*, sometimes *calcareous spar*, and masses of *green earth* of elliptic shape, sometimes botrioid-shaped *rock crystal*.

B. COMMON ALMOND STONE.

To this variety belong the softer kinds, whose principal component part is indurated clay. In this stone there are found occasionally, *calcedony*, *steatite*, *lythomarge*; sometimes grains of *calcareous spar*. It is found of a greyish, reddish grey, and of a pale greenish grey colour.

Moun-

Mountains formed of this stone, are found in the county of Glatz, in Upper Laufatia; at Albertsdorff, in Bohemia, near Schlackenpert, and Carlsbad; in Saxony, near Zwickau; in the bishopric of Fulda; Hesse; near Franckfurth on the Mayn; in the Palatinate; in Derbyshire; in Iceland; and on the Feroe islands, where it rests upon coals.

4.

SLATY CLAY, or *stratified argillaceous Shistus*.

This stone is an argillaceous shistus, which softens in water, and contains generally impressions of shells, and plants. It is generally found under and over coal flötz; it is known by the name of *herbaceous shistus*. Germ. *Kräuter Schiefer*. In Saxony it is found in coal flötz, near Dresden, and at Planitz, near Zwickau.

5.

ALUMINOUS SHISTUS.

This is an argillaceous shistus, mixed with *sulphur pyrites*, and occasionally *bitumen*. Clay is always the predominating part; *sulphur*

phur pyrites is sometimes found in large quantities, sometimes only in small pieces interspersed, and sometimes so intimately mixed, that it can hardly be distinguished from the last mentioned substance, except by the aluminous taste.

It is often found in the state of decomposition, as it absorbs oxygen from the air, or other gases; it becomes acidified, and forms with the clay, the aluminous matter which effervesces out of its surface.

It belongs to the flötz mountains, and is frequently found in Norway, Sweden, and in various parts of Germany.

6.

FLÖTS LIME STONE.

A. COMPACT LIME STONE.

This stone generally changes into *marl*, seldom into *sand stone*.

In Thuringia, and in the adjacent countries, large flöts of bituminous marl shistus are found. It generally exhibits marks of heterogeneous substances; displays also dendritical figures, and is often mixed with *granular lime*

lime stone, with *crystallized calcareous spar*, *sulphur*, and *sulphur pyrites*.

B. SWINE STONE.

Germ. *Stinck stein*.

This is a lime stone intimately mixed with *petroleum*; it generally rests upon mere *calcareous earth*, of an ash grey colour.

7.

MARL.

This substance is composed of *lime* and *clay*.

a. *Indurated marl*.

This stone contains often *echinits*, *orthoceratites*, *amonites*, &c. Sometimes impressions of plants and fishes; it is not met with in lime and coal flötz.

In Saxony, it is principally found in the mountains of copper-flate, near Eisleben, in Thuringuen, Sangerhausen, Buttendorf, Ilmenau; in the lime rocks of Werau, and in the coal mountain of Dresden, where it bears provincial names, viz. *zeckstein*, *hammerkalch*, and *kohlenstein*, &c.

b. *Bitu-*

b. *Bituminous marl schistus.*

This is a slate, composed of *clay*, *lime*, and *bitumen*; it contains often impressions of fishes and sea plants; *native copper*, *copper pyrites*, *vitreous copper*, *copper green*, *azure copper*, and *variegated copper*; found in the slate mountains of Rothenburg, Eisleben, Glücksbrunnen, and Ringelsdorf.

THE following stones are chiefly composed of kernels, or pieces of different sizes, mostly small, which are conglutinated by different substances, which are more or less visible; the substances by which they are conglutinated, are either *silic. argill. calcar.* or *feruginous earth*, and exhibit accordingly different degrees of hardness and texture; and according to the nature of the component parts, different colours.

8.

SAND STONE.

Saxum arenaceum.

Germ. Sand stein.

This stone is composed of small particles of quartz, and of other stones; sometimes it contains micaceous particles. The different substances

stances of which it is composed, are conglutinated by *clay*, *lime*, or *oxyd of iron*, or by an unknown glutinous substance, to which the coherency of particles forming whole mountains, must be ascribed; the sand stone is found of various colours, brownish red, greyish white, greenish grey, white and reddish brown, sometimes containing kernels of *feldspar* and *micaceous schistus*, of *flint*, of *mica*, and sometimes a little *cinnabar*.

It contains accidentally extraneous fossils, such as *echinits*, *pectinits*, *asteria*, &c.

Its texture is sometimes very compact, and the particles hardly distinguishable; other kinds have a granulated texture; it is found of different degrees of hardness, sometimes soft and friable; it hardens when exposed to air; and certain kinds are so hard as to strike fire with steel; other kinds are porous, and admit the water passing through, and that kind is used for filtering water. It is found in Mexico and Germany. The sand stones are employed in common life for various purposes, according to their nature and degrees of hardness; for instance, when they admit to be cut, and do not absorb water, they are used for building, and when they are of a fine texture, and less hard, they are used for common grinding stones; and when

when they are unalterable in fire, they are used for building the inside of melting furnaces; when they are hard and compact, they are used for mill-stones; the hardest kind serves for the foundation of bridges; certain kinds are decomposed by air, particularly such as are found near the sea; some of these contain saline particles; are porous, absorb water, which, when exposed to cold air, occasions them to crack; they are therefore not proper for building.

The common sand-stone, in which the particles are conglutinated by siliceous matter, contains occasionally kernels of feldspar, micaceous schistus, flint, mica, and cinnabar, sometimes also extraneous fossils, as *echinities*, *turbinites*, *asteria*.

The other kind of sand-stone, in which the particles are cemented by a substance of argillaceous nature, contains occasionally *calcareous spar*, *flint*, *argillaceous schistus*, *quartz*, impressions of plants, also *echinities*, &c.

Another kind in which the cement is ferugineous earth, exhibits a red colour, and contains at times, *turbinites*, *histerolites*.

The *grey wacke* is also a sand-stone composed of *quartz*, and a great portion of *siliceous schistus*; sometimes also *argillaceous slate*, and *mica*. The particles are of different size, and

and generally conglutinated by a mass of *slaty clay*.

It is generally compact, sometimes has a *slaty appearance*, and contains now and then petrefactions and corals.

The two following varieties of sand-stone may be particularly noticed.

VAR. I. WHET-STONE.

Saxum quotarium Wallerii.

Cronst. *Saxum compositum mica, quartzo et forsan Argilla Martiali in nonnullis speciebus.*

This stone has a *slaty texture*, and is rather soft; it is sometimes mixed with *mica* and *quartz*; it may be easily divided into plates; is found in layers; when broken, it has a *clayey appearance*; is a little glittering, and exhibits generally a fine grain. The coarser kinds of *whet-stone* are evidently composed of *siliceous sand*, cemented by clay and lime, assisted by moisture. It contains besides the micaceous particles, *oxyd of iron*, from which arises its different colour. Those *whet-stones*, whose particles are cemented by a *clayey substance*, are
the

the hardest, and are of two different qualities; one kind is of a very fine texture, and is used for setting razors; the other, which is of a coarser texture, is used for grinding; both kinds strike fire with steel; that which has a slaty texture, is used for covering houses and walls. Those whet-stones which are cemented by calcareous matter, have the least coherency, effervesce with acids, become harder when exposed to air, and are sometimes substituted for marble.

Amongst the sand-stones, there are some which exhibit a porous texture, and those are found in Mexico and in Germany; they admit water to pass through them, and are therefore cut into funnel shaped stones, and used for filtering and purifying waters. The whet-grinding—and sand-stones, generally form large layers in mountains, they seldom indicate ores.

VAR. 2. MILL-STONE.

Waller. *Saxum Quartzo et Steatite mixtum, fissile.*

It is a mixture of small particles of sand, conglutinated by clay; its principal constituent parts are *lapis ollaris*, *micaceous spar*, and *micaceous*

ous quartz. Sometimes contains *red garnits*, and *white crystallized shörl*. It is used in corn-mills; it often indicates ores, particularly tin, and lead, ores.

PUDDINGSTONE.

Germ. *Wurmstein*.

This consists of small, roundish, or oval pieces of *quartz*, *micaceous schistus*, or *flint*, which are sometimes conglutinated by a clayey mass; sometimes by *jasper* or *quartz*.

The most beautiful kinds are found near St. Albans, in Hertfordshire. To the class of puddingstones, belongs the stone called *Nagelfluhe*, by the Swifs.

9.

COAL.

It is chiefly composed of inflammable matter, or indurated bitumen, mixed with earthy particles. It originates from decomposed wood, or other vegetable substances. It is found of various colours, viz. deep blueish, brownish, or iron black; when broken, it exhibits a conchoidal, sometimes a flaty, lamellated, and uneven texture.

Z

It

It contains sometimes *pyrites*, *silver*, *manganese*, and also gangues, which contain *copper pyrites*, *galena*, *fluor*, and *calcareous spar*; sometimes, though seldom, it contains extraneous fossils, *mytulites*. The coal flötz, with regard to their situation, alternate with flötz of *marl*, *lime-stone*, *sand-stone*, though seldom with *bituminous shistus*.

Coal flötz are often found one laying over the other, and the strata are merely divided by thin layers of clay; sometimes they are found in the state of gangues; they are also frequently found covered with *sand*, *clay*, *wacke*, and *basalt*.

Coals are also found, containing remnants of wood, not yet decomposed; and it has been supposed, that the transmutation of the wood, collected together by water, was occasioned by water impregnated with vitriol, and that the vitriolic acid changed the refinous and oily parts of the wood into petroleum.

It forms considerable flötz or strata in China.

10.

CHALK.

Lat. *Creta*.

The chalk flötz generally alternate with strata of flint, and are only found in the lower flat countries, particularly on the sea coast; they are found on the two opposite coasts of England and France, along the British Channel, in great quantity in the Netherlands, and in various Danish islands, particularly on Zealand and Moen, also on the islands Rügen and Candia, which has obtained from them, its present, as well as its former ancient name *Creta*. The coasts and rocks, where such flötz are found, have generally a grotesque appearance.

Respecting the question, how beds of flint have been formed in chalk flötz, Mr. Wiedeman supposes, that the flint in the chalk flötz was formed by a precipitation from the water, which is probable; chalk is often so loose, that certain parts of it are washed away by water, which occasions cavities, into which a liquid flinty mass may enter. The manner in which the nodulous pieces of flint, and the great number of echinits in the flints

Z 2

have

have been formed, has been explained by Mr. Werner in the following way: He says, that after the flötz strata, precipitated from water, had begun to harden, air had been extricated, which endeavoured to penetrate through the soft mass of chalk, but not having sufficient expansive power to break through, remained therefore incarcerated and formed thus larger or smaller cavities, in proportion to the quantity of air which was extricated. But when the chalk gradually dried, it cracked in different parts, the incarcerated air escaped, and left empty cavities, into which the liquid mass of flint, which formed the upper part, entered, and covered, or encircled the shells or echinits, which, during their decomposition, may also have produced gases, and thus contributed to the formation of the cavities. And as the liquid flinty mass possessed a greater degree of cohesion, than the loose chalk, it was natural to expect, that at those places, where the flinty mass and the chalk came in contact by entering through the small fissures, more or less particles of chalk, in proportion to the different degrees of liquidity of the flint mass, and compactedness of the chalk, had combined with the liquid flint mass, and had thus entered in a greater or less degree
into

into its composition; and thus he explained the formation or origin of the nodulous pieces of flint, and the petrified echinits, which frequently occur in chalk flötz, and also the incrustations of chalk, and the different degrees of purity of flint which often effervesces with acids, which Mr. Gerhard considers as occasioned by a transmutation of the chalk.

11.

ROCK SALT.

This substance seldom forms whole mountains; it generally occupies certain parts of flötz mountains of the later formation, which only occur in flat countries. It is found in Galicia, Hungaria, &c. in Poland and Transylvania; it forms large masses, of an extent of 120 German miles long, and 22 broad.

12.

GYPSUM.

This substance forms a peculiar kind of flötz mountains; it is met with either under *lime* and *sand stone*, or under *loame* and *sand*. It is sometimes found placed in alternate order with *lime-stone*, *sand-stone*, *marl*, or *clay flötz*.

13.

FERRUGINOUS CLAY FLÖTZ.

1. *Common argillaceous iron-stone.*
2. *Bituminous shistus.*

The principal mass of the ferruginous clayey strata, is the argillaceous iron-stone, which with regard to its situation, alternates with strata of clay, and bituminous shistus, seldom with sand-stone. In this state it is found at Weraw, in Upper Laufatia; near Tarnowitz, in Upper Silesia, &c.

14.

CALAMINE.

Lat. *Lapis Calaminaris.*

This substance also forms flötz or strata, containing occasionally *galena*, which is found near Olkusz, Bolesław, Ligota, &c. in the Cracowien mountains.

DIVISION III.

Products or component parts of the
ALLUVIAL MOUNTAINS.

1.

TUFF STEIN *by the Germans.*

This stone consists of *calcareous* and *argillaceous earth*, and now and then of *sand* and *oxyd of iron*.

It

It is found white, grey, and also yellowish grey. It is seldom found compact, generally porous, and often occurs in the state of incrustation; sometimes it constitutes the cement of *sand stone*, and *flötz-lime*, *porphyry*, &c. It forms that kind of fossil, which is called *conglomerate*, and contains frequently river and sea shells, impressions of weeds and leaves, also bones and teeth of various animals. It is found particularly on the banks of rivers, in separate incoherent pieces.

2.

BITUMINOUS WOOD.

This substance occurs also occasionally in the alluvian mountains, though the greatest quantity of it is found in flötz mountains.

3.

LOAM.

Germ. *Laimen*.

This is a mixture of lime and sand; it effervesces with acids, and melts easily in the fire; Mr. *Vogt* is of opinion, that the loams originate from decomposed or mouldered stones, which have been gathered on places which

were formerly occupied by the sea; such may be seen in the country betwixt Weissenfels and Leipzig, also near Querfurt, where it forms large beds. Sometimes it is apparently divided by layers of *coarse sand, quartz, and horn-stone*; it also contains sometimes kidney-shaped *iron stone*. Germ. *Eisennieren*.

4.

SAND.

This consists of distinct kernels or grains, which are rough to the touch, and cannot be softened, nor penetrated by water, nor by any acid, except the fluoric.

a. *Quick sand.*

Germ. *Quel sand.*

This consists of pure, colourless, semitransparent, round, or angular quartz grains. It is found in the sea, on shores, and along coasts; it is also thrown out of springs.

b. *Dust sand.*

Germ. *Flug sand. (Flying sand.)*

This

This consists of sand-like particles, so fine as to be scattered about by the wind.

c. Common sand.

Germ. *Gemeiner sand. Heyde Sand.*

Which is found on places called commons or heaths. This is a mixture of grains of *feldspar* of various sizes.

It originates from decomposed granit, to which also belongs the grits.

5.

POTTERS CLAY.

This substance is not only found in Alluvial, but also in flötz-mountains.

Products of the alluvial mountains.

a. Marshy iron ore.

b. Aluminous earth.

c. Turf.

Turf is a substance composed of the combustible parts of vegetables, impregnated with bitumen. The following varieties are known.

The

The pitch Turf.

Moor Turf.

Moss Turf.

Heath Turf, &c.

To the alluvial mountains may be added the division of such, as are called in Germany, Seifengebürge, (fil. soap mountains) valley mountains, which exhibit irregular masses of *granit* and *gneifs*; which are mixed with *clay*, and from which, *tin*, *gold* and *cinnabar* are occasionally separated by steam works. They are generally found in deep extensive valleys.

DIVISION IV.

VOLCANIC PRODUCTS,

May be divided into

1. Primordial products, or such as existed before volcanic fire, and which were thrown out in an unaltered state, by the elasticity of the circumambient air; as *coals*, certain kinds of *basalt*, *amygdaloides*, *sand stone*, *micaceous schistus*, *sienit*, *granit*, *quartz*, *feldspar*, *zeolithe*, *shörl*, *hornblende*, *porphyre schistus*, *olivin*, *mica*, *agath*, *marl*, *lime stone*, *calcareous spar*, *swine stone*, and *leazit*.

2. Into

2. Into volcanic products, or such as have been altered by subterraneous fire, and thrown out of the crater.

A. LAVA.

The lavas seem to be nothing more than basalt, which has undergone different degrees of fusion.

a. Lava Slag.

Waller. *Porus igneus lapideus, facie terrestri aut scoriacea.*

Born. Catal. Raif. *Lave spongieuse.*

Lat. *Scoria spongiosa.*

This substance which appears like a hard, heavy, vitreous slag, issues from mount Vesuvius, like a foam; on cooling, its surface becomes uneven, vesicular, and full of holes; sometimes it takes an undulated appearance. There are lavas which originate from *clayey stones*, and others which originate from *porphyre*, which have undergone a certain degree of fusion. One kind of lava is compact, and contains often *mica* and *garnit-coloured short crystals*. This kind, found at mount Vesuvius,

Vesuvius, takes a polish, and is therefore used for snuff-boxes, and ornaments, &c.

The other kind, which is spongy, and has a porous texture, contains *zeolithes*, *crystallized calcareous spar*, *quartz*, &c. is frequently found in Sicily, on the Lipari islands, and in all the *crater* of the principal volcanoes.

b. Compact opaque Lava.

This constitutes the lower part of the lava stream; it is black and brown, and resembles basalt.

c. Lava Glass.

Waller. *Porus igneus lapidus solidus vitreus.*

Born. Catal. Raif. *Verte volcanique.*

Scoria vitrea.

Germ. *Vulcanishes, or Lava-Glass.*

This kind has undergone a perfect fusion, so as to exhibit a perfect vitreous appearance; its colour is either black or greenish, very seldom semitransparent; it is brittle, and breaks in conchoidal shaped angular pieces. It is frequently found near the volcanic mountains in Sicily, but

but not in such great quantities as the other lava; it is also found in large masses in Iceland.

B. PUMICE.

Germ. *Bimstein.*

Lat. *Pumex.*

Which consists of thin parallel fibres; they are generally white or grey, blackish brown, or reddish and yellow. It is found in the ashes near Vesuvius, from whence it is washed down into the sea. It also originates from the decomposition of granit, or perhaps, basalt.

C. VOLCANIC ASHES.

Are found of a white greyish, or yellow colour; have an earthy appearance; are frequently mixed with pumice; they are projected from Vesuvius to many miles distance, before they fall to the earth, and seem to have been produced by the decomposition of different minerals, which have been altered, and thrown out of volcanoes. To these belongs also the porcelain earth, which is found on the heights of Puzzola, and is composed of *argillaceous, calcareous, siliceous,*

siliceous, and feruginous earth; when exposed to a strong heat, it melts into an opaque glass.

Substances altered by subterraneous Fire.

Werner. *Pseudo, volcanic products.*

To this class belongs the porcelain jasper, the earthy flags resembling lava, the bar-like argillaceous iron stone, and the basalt.

ORGANIZED EARTH.

This substance originates from a decomposition of organized bodies, which entered into the mixture of the stones and earths belonging to the mineral kingdom.

Its component parts are very fine, but without cohesion; it absorbs moisture, like the argillaceous earth, and is then smooth to the touch, and of a blackish colour. After exposure to heat, it effervesces with acids, discovering calcareous earth; when exposed to a very strong heat, it melts into a greenish glass; it generally constitutes the surface of fields, and promotes the growth of plants.

VAR.

VAR. I. VEGETABLE EARTH.

Germ. *Gewächs Erde.*Lat. *Terra vegetabilis. Humus vegetabilis.*

This earth is found in all cultivated places, mixed with more or less clay, sand, and other barren earths. It is black, and somewhat greasy to the touch; is found in forests and gardens; it is mixed with vegetable substances, which tend to fertilize it. Field earth is dry and grey, and not so heavy as the garden earth, and differs in colour according to the different proportions of ferruginous, or other heterogeneous substances; it contains saline particles, which can be extracted by water simply, or by distillation; it yields an empyreumatic oil, and moisture resembling the spirits and oil of tartar.

VAR. 2. ANIMAL EARTH:

Germ. *Thier-erde.*Waller. *Humus animalis.*

This earth differs from vegetable earth, by its inferior gravity. It consists of finer particles than the foregoing earth; its colour is
white

white or ash grey. When submitted to distillation *per se*, it yields volatile alkali, but the vegetable earth yields potash. It is generally found in church yards, and other places where the putrefaction of animal substances takes place. It arises from the decomposition of aquatic animals, and is found mixed with vegetable earth, in stagnant waters.

END OF VOL. I.

ERRATA.

Preface. Page 8. line 18. for *Bruckman*, read *Brückman*.

————— 12. — 2. after *Systema Naturæ*, add *Linn. Edit. Gmelini*.

In the Table of Contents, Page 18. line 19. leave out the words *transparent sbörls*.

————— 29. line 14. for *agerofus*, read *acerofus*.

At the tops of the pages, from 22 to 26, read *External Characters*, for *Cbaracteriftics*.—And from page 31 to 34, *Physical and Chemical Properties of Minerals*, instead of *Cbaracteriftics*.

Page 31. line 23. for *on*, read *to*.

Physical Characters. Page 33. line 4. for *attracting*, read *attract*.

Page 37. line 13. for *with*, read *by*.—And in line 9. for *to distilled water*, read *to that of distilled water*.

————— 19. for *magnesia*, read *magnesian earth*.

————— 39. — 12. for *in*, read *into*.

————— 44. — 13. for *to*, read *into*, and for *by*, read *with*.

————— 67. — 15. add after *shining* a ; and *it is*, and the ; after *texture*, is to be put after the word *broken* ;

————— 69. — 6. for *pellucidis*, read *pellucidus*.

————— 90. — 23. for *colour*, read *coloured*, and the *e* before line 28. is to be left out.

————— 92. — 11. before *arsenical*, put *viz*.

————— 108. — 19. after the word *or*, add *with*, and after *agate* a ,

————— 125. — 11. for *the*, read *its*.

————— 128. — 9. for *lidicus*, read *leidices*.

————— 140. — 22. for *product*, read *products*.

————— 146. — the last. after *argillaceous*, add *earth*.

————— 150. — 7. after *exhibit*, put a .

————— 160. — 15. after *texture*, put *is*.

————— 191. — 12. after *borax*, put a ;—and the . leave out after *heat*.

————— 193. last line. for *in*, read *near*.

————— 200. — 4. for *arbest*, read *asbest*, and for *ollaus*, read *ollaris*.

————— 261. — 13. for *azerosus*, read *acerofus*.

————— 268. — 19. for *astrigent*, read *adstringent*.

————— 271. — 1. leave out the words *also the*.

————— 12. after *lamellar*, add *it is*.

————— 274. — 14. remove the word *and*, and put it after *kremnitz*.

————— 301. — 10. for *costic*, read *caustic*.

————— 322. — 11. for *effervesce*, read *effloresce*.

————— 330. — 14. for *remnants*, read *remainings*.

————— 338. — 21. for *amygdalordes*, read *amygdaloides*.

Schmeisser, Johann Gottfried

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